Surveying and Mapping

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Quarterly Journal
AMERICAN CONGRESS ON SURVEYING AND MAPPING

New Electronic Devices and Special Maps Cut Highway Mapping Costs, Speed Surveys

Throughout the United States, new highway programs are being completed faster . . . and at lower costs. One big reason *why* is the increasing use of aerial surveys coupled with lightning-like electronic computations during highway planning. Aero Service Corp., Philadelphia—a pioneer in the field—is busy now in 12 states from Alabama to California furnishing engineering services and data for preliminary and final location studies.

One survey near Huntingdon, W. Va., for J. Stephen Watkins, Consulting Engineers of Lexington, Ky., and Charleston, W. Va., is an interesting example. Fourteen miles of Interstate Route I-64—a four-lane divided highway—were to be hacked out of the foothills of the Alleghenies. Phase 1 of Aero's work included aerial photography at two scales—one for compilation of a 5 ft. contour map at 1″ = 200 ft. for location studies, and one for a 2 ft. map at 1″ = 50 ft. for photogrammetric cross-sections. Phase 2 was field surveys to establish vertical and horizontal control data for the maps and cross-sections. This basic control was monumented for recovery and use during final staking and layout.

To save time and money, the penciled topographic sheets were not inked. Instead, photo copies were made and auto-positives delivered. These covered a swath ½ mile wide at a scale of 1″ = 200 ft., showing 5 ft. contours and all cultural details.

J. Stephen Watkins engineers studied the maps and refined the route location. Then Aero compiled 1″ = 50 ft. maps of a strip 500 ft. wide centered on the final route location. Roads, railroads, power and transmission lines, fences, bridges, culverts, retaining walls and woods lines were shown. As the design of interchange sites and grade separations were finalized, Aero added 2 ft. contours in these areas, and delivered maps at both 1″ = 50 ft. and 1″ = 30 ft.

After the maps showing the proposed centerline were received from the consultant, Aero took cross-sections by photogrammetric methods at 50 ft. intervals and at significant breaks in the terrain. Readings were made to a width of 300 ft., with wider sections as required by heavy cut or fill.

These cross-section data were punched in IBM Cards and verified. Aero fed these cards as input to a Data-plotter,

Air photo shows proposed highway center line. Topographic map of the same West Virginia area shows 2 ft. contours and portion of cross section locations.

which plotted cross-sections on Federal Aid cross-section sheets. Scale was 1″ = 10 ft., horizontally and vertically. Conferences between Aero's and client's engineers established the desirability of a smaller scale, and the sections for the latter portions were plotted at 1″ = 20 ft.

For the earthwork volume computations, Aero prepared the data so that it could be processed in Watkins' new Bendix G-15 computer. In other cases, Aero could process a duplicate set of punch cards in the IBM 650 Computer. Then Aero would deliver a tabulation showing cut, fill and net volume at each station, as well as accumulated cut, fill and net, plus slope stake offsets. Accuracy of all such computed volumes are checked with input data. Net result: substantial savings in time, manpower, money.

In California, Aero provided the State Highway Department with a Photo Contour Map. It will be used as a planning tool for preliminary studies. Photo Contour Maps give highway planners a more complete picture of route possibilities.

Aero's engineers will be glad to provide more information about its capabilities and to discuss photogrammetric engineering solutions of highway survey problems. Aero's fully integrated mapping services include topographic maps, photo-mosaics, and preliminary and detailed studies of engineering soils and geology for highway design (photo interpretation, drilling, sampling, testing and engineering reports). Aero Service's headquarters are at 210 E. Courtland St., Philadelphia 20, Pa.

SURVEYING AND MAPPING

Editor-in-Chief
Howard S. Rappleye

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The Surveyor's Notebook

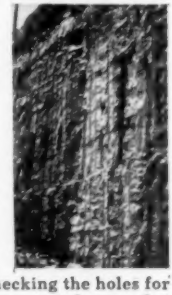
Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

Optical Plummet solves problem on Niagara Power Project

"Sometimes a seemingly little thing can make a big job easy," says Frank Dickey, Project Engineer on the Niagara Power Project for Channel Constructors—a joint venture of Peter Kiewit Sons' Co., Morrison-Knudsen Co., Perini Corp., and Walsh Construction Co.

"We had an unusual problem here on excavations for the 500-foot-wide channel which will handle the water for the new Niagara hydroelectric plant. The conduits will pick up water from the Niagara River a couple of miles above the Falls and carry it underground through the city to an open channel, reservoir and 2,190,000-kilowatt power plant located several miles down the river.



"The channel had to be cut from dolomite. We decided to line drill the full 105-foot depth at one time, using 6-inch diameter holes on 5-foot centers. It was our intent to line drill the entire job, some 1600 holes, before any of the excavation was finished to grade. This made it necessary to devise a method of checking the holes for plumb from the surface so as to be sure that they did not deviate enough to get outside the tolerance allowed by the specifications.

"We thought of several ways to do this but none very practical, until one of the men mentioned having used a Gurley Optical Plummet Transit on another kind of job up in Canada. We decided to try the 'bobless transit' here.

"We set up over the opening; then leveled the instrument with the North plate bubble over two opposing leveling screws. Then we sighted in the Optical Plummet and started moving the other two opposing leveling screws until we were able to pick up the light—by means of the 'OP'—from a dime store flashlight which had been lowered into the hole by a string.

Frank Dickey (r.) checks Gurley Optical Plummet Transit on Niagara Power Project job.

"While moving the two opposite screws, we constantly checked the North plate vial to make sure that it remained level throughout the movement. After we picked up the light from down the hole, we moved the telescope until its bubble was in the center. When this was established, we read the vertical circle—this giving us the angle at which the hole had been drilled.

"This proved to be accurate and a fast system for checking the holes and undoubtedly gave us a better job than we could have otherwise obtained.

"This use of the 'OP' is a special case," Mr. Dickey added. "But I'll bet there will be many other jobs that the 'OP' can lick. For years I cussed the plumb bob, especially when the wind was blowing...always wished someone would do something about it."

You, too, can do something about the plumb bob problem. Gurley *built-in* optical plummets eliminate outmoded bobs...save set-up time... improve accuracy. *Bulletin OP-100 gives complete details on two models available.*

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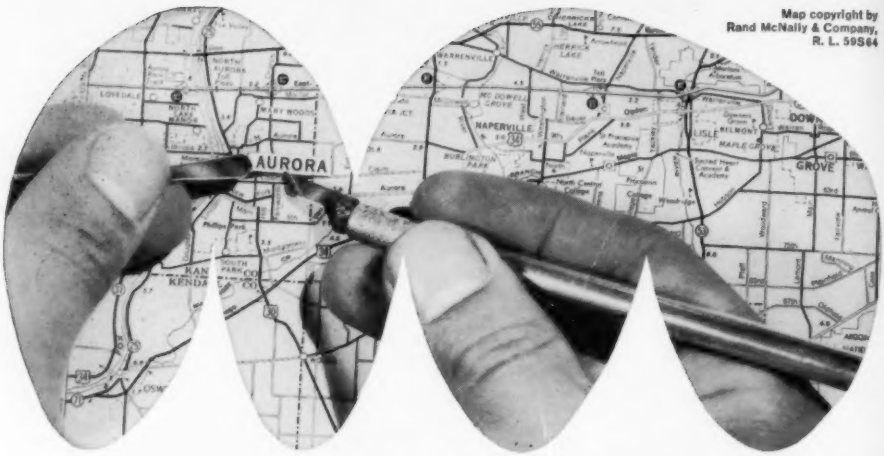

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The Feindt's Prescriptions for Faulty Descriptions

By MARY C. FEINDT

CO-OWNER, CHARLEVOIX ABSTRACT AND ENGINEERINNG CO., CHARLEVOIX, MICH.

ARE YOU HAPPY? Most folks are about as happy as they make up their minds to be. Jonathan had one explanation for it. He was promised a new puppy for his tenth birthday, but had a tough time choosing between a dozen likely candidates at the neighborhood pet shop. Finally he decided upon one nondescript shaggy pup who was wagging his tail furiously. Explained Jonathan, "I want the one with the happy ending."

In the hope that this talk with you today will have a happy ending, I have made up my mind to be happy about being here. Not only am I happy to be here, but I am tremendously interested in this proposition. I remember, by the way, that that is what a man in Charlevoix recently said. A wealthy summer resorter received a note from a black-hand gang saying that, unless he left with them a certain large sum of money the midnight of a certain night on the bridge connecting the north and south sides of town, they were going to kidnap his wife. Well, of course, the rich man came and placed on the bridge a small bag and retired. As soon as he had gone away, the leader of the black-hand gang rushed out and opened it and found, not the money that they had anticipated, but, instead, a bunch of rocks and a note that said, "Allow me to assure you, gentlemen, that I am tremendously interested in this proposition."

I am really interested in talking with abtractors about surveying. To me, there are no two professions more firmly woven together. Many of you have combined abstracting with law, which is also closely related.

My father is an attorney, but I didn't inherit any of his ability along that line, nor my mother's ability as an artist. The only thing I inherited from them was the ability, at the age of six months, to put my toes in my mouth—you know, that constant struggle to make both ends meet.

Back in 1938 (in order to make those ends meet) I came to Charlevoix to work for the Sloans, the former owners of our business; but only for two months—and I am still here. I like living and working in Northern Michigan, even though I often do tell folks I live in the "sticks," being so far away from city activities. One reason for my being happy in this northern country is that I met my husband soon after I landed. A teacher sent a routine questionnaire home with a pupil requesting information on home environment, number of brothers and sisters, father's occupation, etc., and the next day he received a scrap of paper from the mother of the pupil saying, "I have 18 children. My husband can also do plumbing and carpentry work." We have only one child, so my husband has had time to learn surveying and abstracting and work with me.

We have had many discussions over descriptions and the proper way of preparing them. Of course, we are not always in agreement, but we do have a few common prescriptions which we like to refer to as "The Feindt's Prescriptions for Faulty Descriptions."

Descriptions are often like mousetraps—easy to enter into and often difficult to get out of.

We firmly believe that, wherever and whenever it is possible, a survey should be

From an article under the same title which appeared in *Title News* (the official publication of the American Title Association), Vol. XXXVII, No. 12, December 1958. Presented at the 1958 Convention of the Michigan Title Association.

made before a description is composed. Have you any idea of how few folks have any conception of how long 100 feet is—or 50 feet? A client may have in mind a certain area which he wishes to convey, but, due to his misconception of footage, he may convey more or less than he is intending. Not too long ago a man ordered a survey for a piece of property which he had already conveyed to his neighbor. The attorney made the description for him. There was nothing wrong with the description except that, when we established the corners on the ground, we found that this poor man had sold a row of his favorite plum trees.

Quite often we are asked to survey a parcel which has been described as running to the road. Does that description mean to the centerline of the road or to the right-of-way line? In a one-acre parcel, approximately 208 feet square, a strip of ground 33 feet or more in width off one side of it makes quite a bit of difference. Too many descriptions leave too much to the imagination.

Frequently we are asked to lay out a parcel described as the north half of a government lot. Is that the north half by acreage or the north half using the north-south lines as the basis for dividing the parcel in two? Technically, it should be the north half by acreage, but too often lines have become established wherein the original owners had other ideas in mind. A line established on the ground will control over all methods the books offer for dividing. The rules of the book are all right where no previous lines have been established. We spend hours searching to determine how lines had their beginning and what the original intent was. What are we to use as the basis for acreage when one side of the property is bounded by a body of water? How close to the water shall we run a line to determine acreage? Are we to use the original meander line? What about the government lot in the Petosky area where the government's meander line cuts off a point of land containing an area close to 12 acres jutting into the lake? Do we compute the acreage in that case including or excluding the point of land? Or shall we forget acreage completely and divide the parcel according to the north-south distance?

DIAGONAL LINES

And how about the lot whose lines run diagonally to the north-south lines? What is the north half of a lot whose lines do not run north and south? We urge you again, when making descriptions, to leave nothing for the imagination. When it comes to subdividing government lots, use metes and bounds descriptions and forget the fractions. When a lot does not lie north and south, remember to describe it as the northeasterly half or here again use metes and bounds. And don't refer to a corner of such a lot as being the northeast corner—call it the northernmost corner or some similar name.

Since we have in our area so many bodies of water, we have many irregular sections and many government lots. We sometimes find descriptions made up of lines parallel with quarter or eighth lines which have never actually been intended to be established by the government surveyors. How are we to run a line which has been described as being parallel with a quarter line which has never been established? All descriptions should be made to conform with the lines established by the government surveyors.

In theory a section of land is a mile square, but if we find a section which measures out at 5,280 feet on the ground, we know something is most likely phony. The lines established by the early surveyors (and which lines run by them hold today) were never accurate. How could they be with the equipment they had to work with and the number of miles they had to cover in the rough and swampy terrain they sometimes had to cross in a single day? All of Beaver Island is supposed to have been surveyed by the government surveyors in two months in the winter time. This island is over 14 miles long and 7 miles across, with an irregular shoreline. Some of it must have been done in a tent. When property is to be subdivided, some provision must be made to take care of the overrun and underrun. The so-called forty-acre parcel re-

ferred to by the farmer never is exactly 40 acres.

THOSE "GAPS"

In Charlevoix, half of Section 26 is also half of Section 23. Somehow the government surveyors, in laying out the sections from opposite directions, lacked half a section when they met. The width of a section, as explained before, not being originally accurately measured, it would either cause an overlap or a gap in a description if it were not referred to as a fraction of a section. In other words, never describe the northeast quarter of the northeast quarter as a parcel bounded by a line 80 rods (or 1,320 feet) in length unless it does actually measure that on the ground.

John Doe, a resorter in the Charlevoix area, owned the following described parcel: "Part of Government Lot 1 of Section 21, Town 33 North, Range 7 West, described as follows: Commencing at the southwest corner of said Lot 1 and running thence north 38 rods along the west line of said lot, running thence at right angles east along a line parallel with the south line of said Lot 1 to the South Arm of Pine Lake, running thence in a direction nearly south and along the easterly line of said Lot 1, running thence west along the south line of said Lot 1 to the place of beginning, containing 20 acres, more or less." The easterly side of this property extended to the waters of Pine Lake, which lake is now renamed and known as Lake Charlevoix.

Mr. Doe contended he should have at least 38 rods of lake frontage, even though his north and south lines were bounded by old fence lines and the distance between, as measured along the shore, lacked approximately 30 feet. Thirty feet of lake frontage at its present value made the property worth fighting for. We were asked by Mr. Doe to survey the land for him—that is, to stake out his 38 rods, even though it meant placing the lines both north and south of old existing fences. We refused on the grounds that we could not conscientiously do it for him. We offered to survey the fence lines and give him a picture of what actually existed and suggested that he take the matter to an attorney. Other surveyors did run the lines for him according to the description and without regard to the fence lines, and a nice court battle ensued. The outcome was that the fence lines did hold and Mr. Doe was the loser of his 30 feet. I think that before the trial was set Mr. Doe began to worry about that old fence and proceeded to tear it down, but he could not remove the evidence of the line the fence had occupied and the few blazed trees here and there along where it had been. We happened to be passing by this place the day the judge, the attorneys, and the owners of the two adjoining lands were walking the lines and they hailed us and asked us to walk the lines with them. We pointed out to the judge where the old fence originally stood. At one particular place along the line, the judge kicked over an old pail and underneath happened to be the stub of an old post which Mr. Doe had failed to remove. The judge said, "This looks like an old post," and Mr. Doe, whose face was pretty red about this time, said, "So it is, so it is." This is just another case of a theory that does not apply on the ground.

This situation is true not only in government subdivisions and metes and bounds descriptions, but on recorded plats. Many of the old time plats are not true. In Charlevoix, John S. Dixon, one of our early surveyors, put an extra link in his chain in order to give everyone good measure. Several of our blocks have as much as 8 or 9 feet overrun in them. So, when a lot is divided, one part should always be referred to as the north or south exact number of feet and the remainder should be referred to as the entire lot with the exact number of feet subtracted from it. If, after having conveyed the north 20 feet of a lot described as being 80 feet long, the remainder had been described as the south 60 feet, there would be a gap of no man's land in the case of the overrun just mentioned.

HARD FEELINGS

Faulty descriptions can cause some mighty hard feelings and real court battles. There is a fan-shaped lot in one of the outlying plats of Charlevoix. The north side

of the lot has 117.2 feet and the south side has 110 feet. Mrs. Doe bought the east 55 feet of the lot and then bought the west half of the lot, thinking she was then getting the entire lot. What happened? Because the north side had 117.2 feet, this left a triangular shaped piece of ground 3.6 feet wide on the north side and tapering to a point on the south line which she did not own, and it so happened that the title owner to this triangular parcel of ground was her arch enemy and refused to give up the title to the parcel. Carelessness and ignorance of the facts are the greatest faults in making descriptions.

Lawrence and I are both cranks on having directions qualified. In theory, lines which run east and west should have 90-degree angles with lines running north and south. Practically, that isn't true. I know of about three or four cases where I have found 90-degree angles on the ground. They are rare. We have in our office right now a client who owned a parcel described as beginning north 600 feet from the southeast corner of the section, thence west 320 feet, thence north 100 feet, thence east 320 feet, thence south 100 feet to the point of beginning. The early surveyor established the south and north lines of the property as running west at 90-degree angles to the east section line. The present surveyor came along and laid out parcels farther to the south and saw that the angle at the southeast corner of the section was not 90 degrees. He laid out the lines of his parcels as being parallel with the south line of the section. Now the man in the middle between the old survey and the present survey was squeezed. He did not have his 100 feet on the back. In fact, he lacked 13 feet and he was mad. Where was he to get his land? Had all the directions in these descriptions been qualified as being west on a line perpendicular to the east section line or parallel with the south section line, all of the trouble could have been avoided. Now we have a block of folks, some of whom have built according to the opinion of one surveyor and some who have built according to the opinion of another. In either case, somebody in the block is going to lose a part of his house or garage.

Many people, including even surveyors, do not study the records to learn how the descriptions of adjoining parcels have been worded, and fail to tie in with them when making descriptions. We have a survey we are working on now near the town of Bellaire. The owner bought her property in two parcels, one of which was described from the north and one from the south. The line which is supposed to be common to the two parcels has been assigned one bearing to agree with those from the north and another to agree with those from the south. The way in which this works out when the parcels are drawn out on paper leaves a gap between them to which she has no title. The owner of the property with no title has moved away and cannot be found. Even though the bearings did not fit originally, the line could have been described as "north 88° west, previously having been described as north 87° west" so that the abstractor, surveyor, and attorney would know that this line, having been described by two different bearings, was intended to be one and the same. Or the line might have been described as being along the line of the adjoining owner, or reference made to the liber and page of the adjacent parcel to show that the intention was to have the two parcels join.

MONUMENTS

We believe that, in making a description, it is very important to reference permanent objects. We have been advised by the attorneys that an object holds over a distance. Thus, if we are going east 100 feet to a concrete monument and the concrete monument is there on the ground but measures only 99 feet, the concrete monument is the corner and not a point 1 foot east of the monument. Wherever it is at all possible, we refer to the corners as monuments, irons, or whatever object we can use to describe the point in order to make the description more permanent.

Quite often we find a description to lay out which begins at the north shore of Lake

Charlevoix, but, with a lake which rises and falls during the years, the point of beginning changes each year. A parcel which has as its point of beginning the shore of a lake is a parcel with a different location each year. Sometimes the parcels are described as beginning at the northerly line of Boyne City and Charlevoix Road. This road is a trespass road and its exact centerline has never been established. We take a look up and down the road and pick a centerline. The next surveyor may pick a point a foot or two away. Who is right? The point of beginning should be some known point such as a section or quarter corner.

Often descriptions begin at the corner of a recorded plat, but the plat itself is so old and full of discrepancies that no one knows for sure where the plat corner is. What sounds good on paper may prove to be a headache for the surveyor and also can develop into an abstractor's problem.

Everyone I have ever talked to about descriptions has a different idea of the proper way to describe land. Even Lawrence and I differ. Lawrence's chief argument is with my use of unnecessary words. He likes to take a description I have composed and cut out the useless words I have a habit of inserting. He always says there is no use in saying "A distance of." Just give the distance, he says. Or, it is not necessary to say, "Beginning at a point 60 feet east"; just say "Beginning 60 feet east."

We, the Feindts, prescribe for fewer faults, the following remedies:

1. Have property surveyed first whenever it is possible.
2. Be definite. Leave nothing to the imagination.
3. Always keep in mind the amount of work involved to establish lines on the ground. Unnecessary field work is expensive.
4. Remember to check the government surveys to be sure the present lines are following what the early surveyors set up.
5. Do not make descriptions on theory.
6. Always keep directions qualified.
7. Remember to include objects whenever possible.
8. Get exact points of beginning.
9. Drop the unnecessary words.

SAMPLE SURVEY

Now that you have heard these prescriptions, and please remember they are only personal opinions and do not cover every case in the book, how would you like to see how we made a survey with one description composed on paper and how we established it on the ground? This particular survey was for the Fass Foods factory at Central Lake. Since we had not made many surveys in that territory, we had no old notes with which to start. The south line of the property was described as being the north line of Thurston's Addition to Central Lake. So the first thing I did was to write the Auditor General's office and order a copy of the plat of Thurston's Addition.

When we first began the survey, we looked for some stakes where we figured the plat lines might be, but we were unable to locate any except for one iron at the southwest corner of the plat which, according to the plat figures, was 849 feet south of the northwest corner of the plat, or 849 feet south of the southwest corner of the parcel we were to survey. According to hedge lines and a few old fence lines within the plat, all indications were that the plat had been accurately laid out. Also, the plat showed that it had been surveyed by Frederic L. Church, who was a careful surveyor.

The west line of the Fass Foods property was also the west line of the section. The iron we found at the southwest corner of the plat of Thurston's Addition was the west quarter corner. We found the iron at the northwest corner of the section. Thus we had two points on the section line and we were able to run a line between them and to establish points along the west boundary of the property we were surveying.

So many folks who order surveys tell of one point which we might use as a starting point for a survey, but they forget that it takes two points to make a line. Early surveyors ran lines by compass. Have you ever tried to walk through the woods on a compass line and come out exactly in the same spot twice? We run our lines by means of

the vernier on the transit, turning 180° angles to produce straight lines. We use the compass only for checking purposes.

To locate the two irons I have just told you about and for checking the other stakes on this survey, we used a dipping needle. This will pull for a foot or two under the ground, depending upon the size of the iron and the quality of the iron. Some have far more magnetic attraction than others.

Sometimes we are not fortunate enough to have irons. The corners have been marked by stones or cedar posts and in these cases we have to start digging. We spent all one hot sunny afternoon digging up the middle of the road for a cedar post which we eventually found. One of the fellows working for me that summer was a school teacher and he said, "To think you and I have our Master's Degrees and this is the way we earn our living."

We are thankful to be surveying now when we do not have to dig for all of our corners and have the dipping needle to help us find the iron stakes. Incidentally, a dipping needle will pull on all kinds of iron as well as stakes. We have dug up various pieces of old junk, tin cans, culverts, gas pipe lines, and, twice, magnetos.

After we had run the west line, we measured north from the southwest corner of the plat 849 feet and established the southwest corner of the property.

Since we could find no evidence on the ground to the contrary, we ran the south line of the property at a 90-degree angle with the west line. This was the angle shown on the plat. Since the south line of the property being surveyed was the same as the north line of the plat, we established that line working entirely from the plat. Usually there is some evidence on the ground to show the angle to be not a 90-degree angle. Often they will vary as much as a degree. When we are surveying in a recorded plat, we check the entire block for iron stakes and old fence lines—any evidence to determine how the block was divided and in what direction the lines were actually run, so that each person in the block gets his share as nearly as possible.

The north line of this property was described as being 420 feet north of the north eighth line of this section, so before the line could be determined we had to establish the eighth line. We found the remains of an old fence line on the west side of the section line road, beginning about 300 feet west of the section line and continuing on to the west. There was no evidence on the east side of the road. There was only one difficulty with this fence line. It was as crooked as a dog's hind leg. There were various lots on the west side of the road, all with metes and bounds descriptions referring to this eighth line. We went to the courthouse in Bellaire and looked up the descriptions of the various parcels so we would know where to search for old corners. We found one concrete monument on the west side of the road and one iron stake and several old fence lines, but when we measured between them we knew something was wrong. They did not check for measurement. Then we began asking some of the folks about their property lines. One lady invited me into her house and it was there I learned that she did not know how many feet there are in a rod. As her description was in rods, she was unable to compute how many feet she did own; so she grabbed a number from mid-air and fenced in the land, including that which did not belong to her. It was her fence lines that were throwing us off on the measurements. When that was figured, we were able to determine where the eighth line was, and from that point and by using a good part of the old fence we were able to get two points on the eighth line and extended the line to intersect the section line. As this eighth line was actually in a different section, it had no bearing on the section we were in except where it intersected the section line. That one point was the only point we needed. It is not true in every case. It would not be true on the north and south lines of a township, for example.

We measured north from this eighth corner along the section line we had previously established and determined the northwest corner of the property. We checked the north line for any previous stakes that might have been placed, but found none.

We checked the descriptions, when we were at the courthouse, for the property adjoining the factory land to the north and found that the land was apparently left for a street. We knew, a least, that there would be no neighbor hollering about the stakes we had placed.

The north line of the property was described as bearing east without qualifications. The west line of the section was described as bearing north, so we interpreted that the north line was intended to be run at a 90-degree angle with the west line of the property. The east side of the parcel being surveyed was bounded by a railroad. Therefore, we extended the north and south lines of the factory land to a point 50 feet from the center of the existing track, measured perpendicularly to the line of the track.

SURVEYOR'S LIFE HECTIC

This is an example of a few of the problems arising from a particular description. Almost every description poses some problem. Lines on the ground just aren't the same as they are on paper. A surveyor's life is hectic. The descriptions on record in Charlevoix do not show that Section 23 has two east quarter corners about 3 feet apart. We searched the old notes and found where Nettleton (a not too accurate surveyor) admitted in 1898 that he could not find the corner and drove an iron pipe where he thought it should be. Robinson in 1912 (a fairly accurate surveyor—especially in his later years) wrote in his notes that the corner was gone, but that he found the old stake hole and drove a well point. Which surveyor is right? Some folks near this quarter corner have descriptions in which Nettleton's corner was used as a point of commencement and others have descriptions in which Robinson's corner was used. We try to follow what was done in the past and identify the corner we use as either the one established by Nettleton or Robinson.

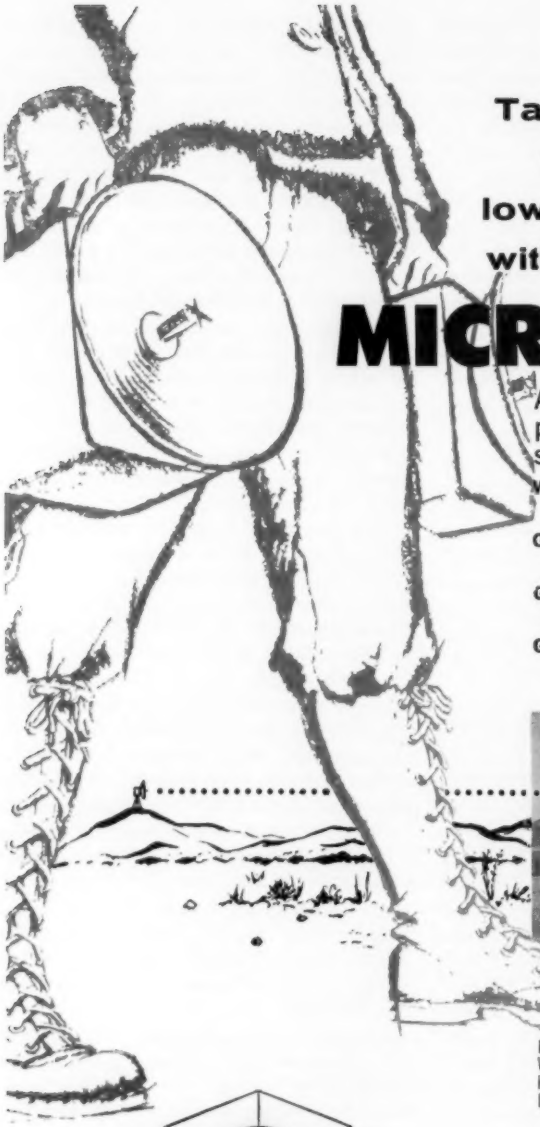
No matter how hectic the surveyor's life is, there is something magnetic about it—something fascinating. Each day presents a new and different problem and a new place to work—perhaps in the swamps, perhaps in the hills, sometimes in the city. We have traveled to our jobs by car, by boat, by airplane, by paddling up a stream, and, yes, even by horse and buggy. A surveyor is an adventurer, an explorer, a detective, a laborer, a draftsman, and, right now, a physician, prescribing cures for descriptions. Let me assure you that this variety provides the spice of life, and I have made up my mind to be happy with it. There are other ways of earning an easier living with more compensation, but as Emerson retailed: If a man makes a better mousetrap, the Internal Revenue Service will beat a path to his door. So, if God is willing, I will probably continue to make surveys and the Feindts will continue to search for prescriptions for those faulty descriptions.

"A Stake in Our Future"

The North Carolina State Highway Commission has published, under the title "A Stake in Our Future—The Story of Highway Surveys," an attractive, two-color, six-page, pocket-size pamphlet for the information of owners of property over which surveys are to be made by field parties of the Highway Commission.

This pamphlet contains, in addition to introductory paragraphs explaining its purpose, the answers to ten questions which often pop up in the minds of those who encounter survey parties working on their properties. This appears to be a serious effort to promote better understanding on the part of the public of the necessity for surveys, the fact that a survey does not necessarily mean that a road will be built along that line, etc.

The pamphlet also includes the names and addresses of the fourteen Division Engineers of the N. C. State Highway Commission, to whom property owners are referred if they require information beyond that included in the pamphlet.



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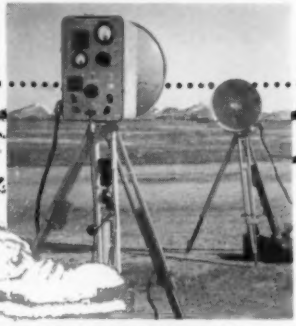

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Electronic Engineering With a Dimension for the Future

Development of Perspective Portrayal for Aircraft Instrument Approach Charts

By DUANE O. MAIN

U. S. NAVY HYDROGRAPHIC OFFICE

THE INCREASING need to travel from point to point as quickly as possible was perhaps the most significant stimulus for the growth of aviation. However, a major barrier to this growth was the inability to navigate safely in weather conditions which did not permit visual reference to the ground. Under these conditions a pilot must rely solely on his cockpit instruments; hence, the origin of the descriptive term "instrument flying."

The first major hurdle of the weather barrier was made possible by the development and utilization of radio sign posts called radio beacons and directional beams from radio ranges which became the roadbed of the first highways in the sky, now known as airways. The use of radio aids to determine aircraft location and orientation created a requirement for graphic representation of these radio facilities in relation to terrain and airfields. This requirement was fulfilled by the development of navigation charts specifically designed for aviation.

As radio aids improved the safety of en route navigation, the weather problem remained at the airfield terminals where landings must yet be accomplished with visual reference to the ground. To strengthen this weak link in the air transportation chain, a system of predetermined maneuvers, known as instrument approach procedures, was devised in relation to radio beacons and radio ranges so that an aircraft could descend on instruments to a prescribed safe low altitude in the immediate vicinity of the destination airfield. From this point the pilot must be in visual contact with the ground for landing approach or immediately climb on the designated "missed approach" course to an established safe altitude. This development in the art in turn created a requirement for graphic representation of the prescribed instrument flight path in relation to the radio aid, destination airfield, obstruction and terrain detail, and associated procedural instructions. The graphics developed for this purpose were called "instrument approach and landing charts," usually referred to as AL charts.

The AL charts portray the most critical stage of flight when a pilot's attention must be divided between his cockpit instruments to maintain prescribed altitude, speed, and heading, and quick scanning of the surroundings through a restricted field of view to establish visual contact with the ground for landing approach. Moreover, the rapid growth of aviation with accompanying congestion of airspace has necessitated a commensurate increase in the number and complexity of instrument procedures. These factors dictate the importance of presenting this information in a clear, concise, and understandable manner. During the years since their inception AL charts have been modified somewhat in content and format, and reduced in size. The initial design which portrayed the procedure picture in separate plan and profile views has not been changed. An example of the standard AL chart now being used by the U.S. Navy and U.S. Airforce is shown in Figure 1.

The U.S. Navy Hydrographic Office is presently experimenting with a new method of graphic portrayal for instrument approach procedures which utilizes the perspective technique. This technique permits the depiction of the procedure flight path in a single pictorial graphic which replaces the plan and profile views presently

Presented at the 19th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 11–13, 1959.

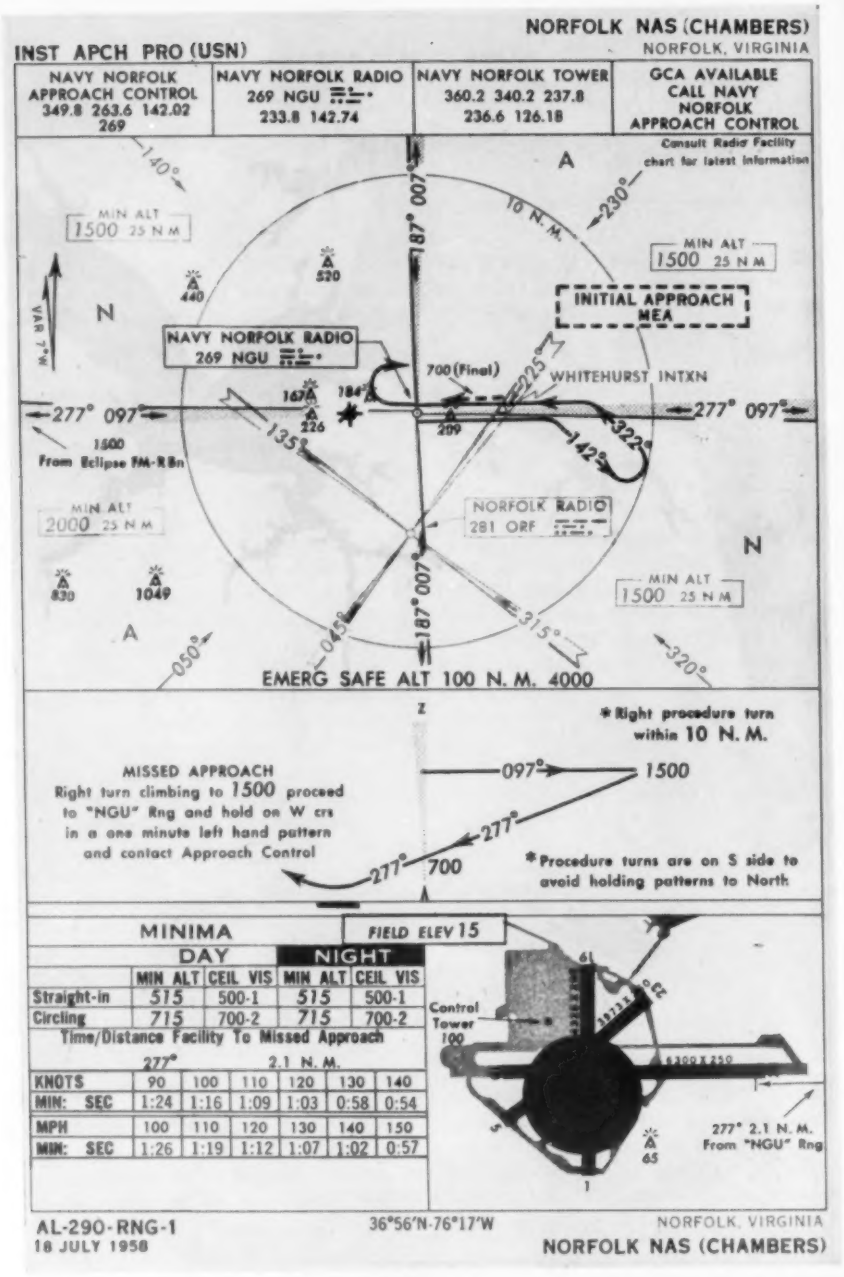
NORFOLK NAS (CHAMBERS)
NORFOLK, VIRGINIA
INST APCH PRO (USN)
NAVY NORFOLK APPROACH CONTROL
349.8 263.6 142.02
269
NAVY NORFOLK RADIO
269 NGU
233.8 142.74
NAVY NORFOLK TOWER
360.2 340.2 237.8
236.6 126.18
GCA AVAILABLE
CALL NAVY
NORFOLK
APPROACH CONTROL
Consult Radio Facility chart for latest information
MIN ALT
1500 25 N M
INITIAL APPROACH
MEA
NAVY NORFOLK RADIO
269 NGU
WHITEHURST INTXN
700 (Final)
277° 097°
NORFOLK RADIO
281 ORF
MIN ALT
2000 25 N M
EMERG SAFE ALT 100 N. M. 4000
* Right procedure turn within 10 N. M.
MISSED APPROACH
Right turn climbing to 1500 proceed to "NGU" Rng and hold on W crs in a one minute left hand pattern and contact Approach Control
* Procedure turns are on S side to avoid holding patterns to North
MINIMA
FIELD ELEV 15
DAY
NIGHT
MIN ALT
CEIL VIS
Straight-in 515 500-1 515 500-1
Circling 715 700-2 715 700-2
Time/Distance Facility To Missed Approach
277° 2.1 N. M.
KNOTS 90 100 110 120 130 140
MIN: SEC 1:24 1:16 1:09 1:03 0:58 0:54
MPH 100 110 120 130 140 150
MIN: SEC 1:26 1:19 1:12 1:07 1:02 0:57
Control Tower 100
277° 2.1 N. M. From "NGU" Rng
AL-290-RNG-1
18 JULY 1958
36°56'N-76°17'W
NORFOLK, VIRGINIA
NORFOLK NAS (CHAMBERS)

FIGURE 1.

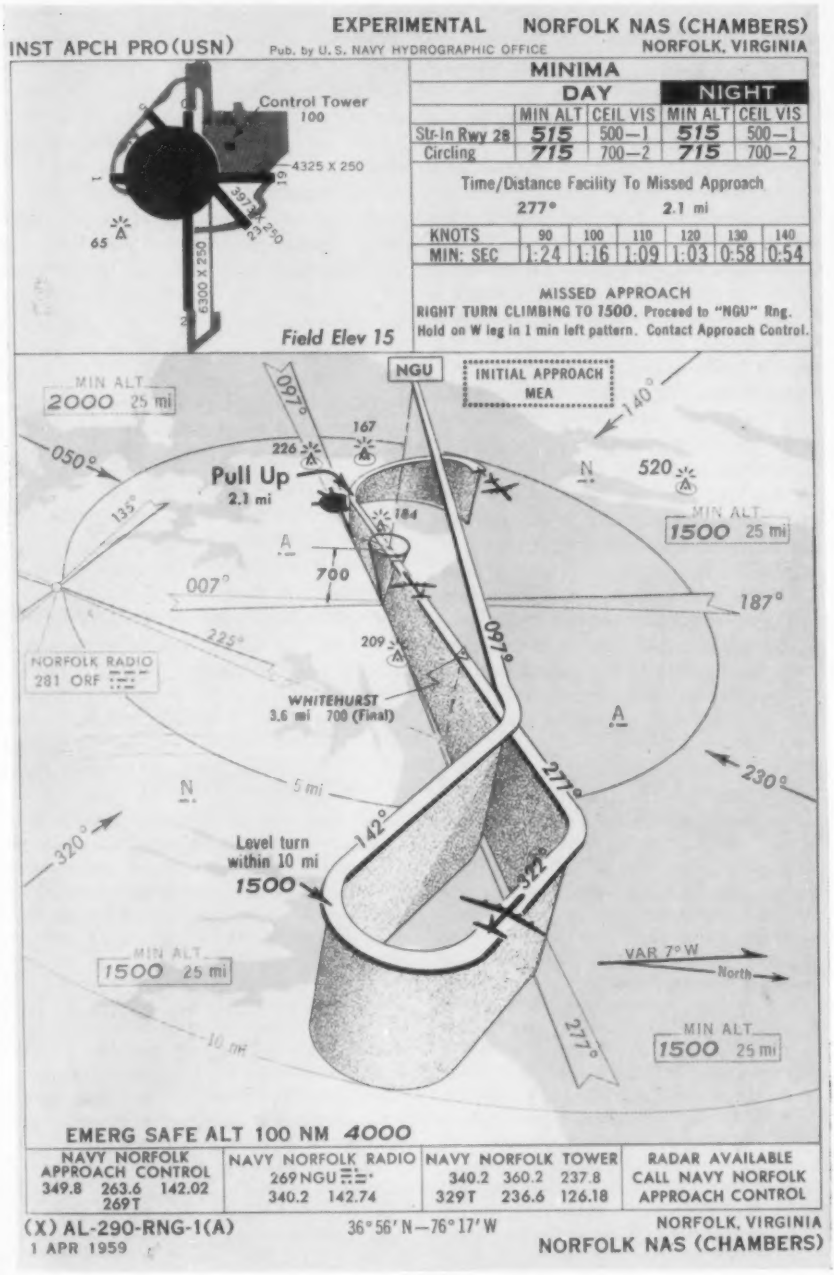
EXPERIMENTAL NORFOLK NAS (CHAMBERS)
INST APCH PRO (USN)
Pub. by U. S. NAVY HYDROGRAPHIC OFFICE
NORFOLK, VIRGINIA
Control Tower
100
4325 X 250
6300 X 250
Field Elev 15
MINIMA
DAY NIGHT
MIN ALT CEIL VIS MIN ALT CEIL VIS
Str-In Rwy 28 515 500—1 515 500—1
Circling 715 700—2 715 700—2
Time/Distance Facility To Missed Approach
277° 2.1 mi
KNOTS 90 100 110 120 130 140
MIN: SEC 1:24 1:16 1:09 1:03 0:58 0:54
MISSED APPROACH
RIGHT TURN CLIMBING TO 1500. Proceed to "NGU" Rng.
Hold on W leg in 1 min left pattern. Contact Approach Control.
NGU
INITIAL APPROACH
MEA
MIN ALT
2000 25 mi
Pull Up
2.1 mi
700
MIN ALT
1500 25 mi
NORFOLK RADIO
281 ORF
WHITEHURST
3.6 mi 700 (Final)
Level turn
within 10 mi
1500
MIN ALT
1500 25 mi
VAR 7° W
North
MIN ALT
1500 25 mi
EMERG SAFE ALT 100 NM 4000
NAVY NORFOLK APPROACH CONTROL
349.8 263.6 142.02
269T
NAVY NORFOLK RADIO
269 NGU
340.2 142.74
NAVY NORFOLK TOWER
340.2 360.2 237.8
329T 236.6 126.18
RADAR AVAILABLE
CALL NAVY NORFOLK
APPROACH CONTROL
(X) AL-290-RNG-1(A)
1 APR 1959
36°56′N—76°17′W
NORFOLK, VIRGINIA
NORFOLK NAS (CHAMBERS)

FIGURE 2.

used on the conventional AL charts. An experimental chart based on this concept is shown in Figure 2. This chart shows a perspective presentation of the same instrument approach procedure depicted on the standard AL chart shown in Figure 1.

The objective of this new approach is to provide a product which gives the user instrument procedure information in a manner that is clear, concise, and easy to follow. All information on this experimental AL chart is arranged so that the chart is read from bottom to top in continuous progression without undue shifting of eyesight. Approach fixes, holding points, maneuvering restrictions, changes in altitude, compulsory reporting points, etc., are located adjacent to the applicable position on the pictured flight path.

An innovation in the design of this chart which might be considered as a significant departure from established charting practices concerns the orientation of the graphics. The standard cartographic practice of depicting north toward the top of the page is disregarded for these charts as the orientation is based solely on the instrument procedure flight path. This flight path is oriented on the chart so as to depict the critical portions of the procedure to best advantage. The perspective view selected for these charts is such that it gives the chart user a portrayal of the procedure flight path as it might be envisioned from a viewing point in space. On the runway diagram the runway on which the instrument procedure is based is oriented so that the approach end of the runway is always at the bottom of the diagram. This arrangement assists the pilot in orienting himself at the critical time of transition from instrumental to visual flight.

Perspective instrument approach charts are prepared from usual source materials. The well known method of similar squares for enlarging or reducing the scale of a drawing is utilized for transferring chart data to a perspective grid.

The perspective AL chart is still in the experimental stage and is an example of the continuing efforts by the Hydrographic Office in the design and development of aeronautical charts and publications.

Pop Bottles to Trace Ocean Currents

For centuries shipwreck victims have been pictured in the act of tossing bottles in the water in the hope of being rescued. A new twist is now being added to this form of communication by the Coast and Geodetic Survey, which is now tossing nearly 2,000 soda pop bottles into the Atlantic Ocean off the New England Coast to find out where the currents will carry them.

Each of the plain glass bottles released from the Survey Ship *Hydrographer* contains two cards. One card requests the finder to "BREAK THIS BOTTLE" so the finder can readily remove the card. It explains the purpose of the operation. The other is a small postpaid form asking for the date and location of the bottle when found.

Eventually all 2,000 bottles will be released from 10 to 35 miles offshore between the eastern tip of Long Island, N. Y., and Boston, Mass. They are part of a large scale study of ocean currents and the date and place of release of each bottle will be on file at the Coast and Geodetic Survey's Washington office.

Survey officials hope to have a large percentage of the cards returned although some bottles may find their way via the Gulf Stream to the opposite side of the ocean. As an added incentive for the return of the cards, the finder will be told where the bottle he found originated. The card informs the finder, "You can add to the knowledge of ocean currents by returning the addressed card with the requested information. You will receive by return mail, information as to where this bottle was released. Your cooperation in giving accurate information will be of great assistance."

Aside from getting the satisfaction of taking part in a scientific investigation a nimble-fingered mariner may be able to remove the cards without breaking the bottle and have a souvenir of his participation. The bottles have no refund value.

The Role of Engineer and Surveyor in Litigation

By DUDLEY C. HOWARD

MAGNOLIA PETROLEUM COMPANY

EDITOR'S NOTE.—This paper was presented by the author to a meeting of Magnolia Petroleum Company Civil Engineers at Dallas, Texas, on June 8, 1956. It was read by J. K. Bivins at a meeting of East Texas Chapter No. 4 of the Texas Surveyors Association on September 11, 1958, and was given by Mr. Howard at a meeting of the Dallas Chapter No. 5, TSA, on November 18, 1958. The illustrative material accompanying this paper, being of the type suitable for presentation before a court, was not suitable for reproduction in the pages of this Journal. While the paper would, perhaps, be more effective if the illustrations could have been reproduced, there is still ample justification for the publication of the text only.

LITIGATION is the result of differences of opinion as to (a) what is right, and (b) what a court or jury might be made to believe is right.

It is an indictment against our fellowman, yet true, that in some instances these opinions are the result of wishful thinking motivated by avarice. Generally, these differences are honest ones caused by mistaken ideas of what is right, due to wrong interpretations of facts, false premises, or a lack of facts both directly and indirectly related.

It is the role of the surveyor or engineer to furnish his attorney facts. The final interpretation of the facts and their manner of presentation to the court are the responsibility of the lawyer. Almost any experienced lawyer will expect and appreciate aid in a digest of the factual evidence and a consideration of the possible interpretations which might be made of them.

In speaking here of facts, I am referring to those which an engineer or surveyor, because of his specialized training, is assigned to assemble through search and research in records and on the ground. There will be considerable investigation to be made in the gathering of these facts, but a surveyor should not attempt to assume the role of investigator outside of his own province. Special investigators are usually assigned to a lawsuit of any magnitude, and they are men trained in their work and know how to get information without giving any away. Even in your own work, it is well to find out from your attorney just how tight a hole he is drilling.

In general, a lawyer, who is experienced in working with surveyors and engineers and who has confidence in his man, is open to suggestions. He usually has a good idea about what he needs or would like to have but appreciates suggestions concerning the preparation of factual evidence for presentation to the court. Do not try to tell him the law, he knows that, and keep in mind that the final responsibility is his, so the final decision as to what facts are to be presented and their manner of presentation must be his.

Realizing that each lawsuit presents its own individual problems and keeping in mind that the surveyor must be guided by the judgement of his attorney, the following are a few suggestions as to the gathering and preparation of factual material for a few types of cases.

LAND BOUNDARIES

As the boundary suits caused by "Vacancy Applications" in Texas usually get more complicated than other property line disputes, we will discuss some of the features in the development of one.

As you have, heretofore, heard talks and papers on where and how to make your search of records and how to conduct your survey and investigation on the ground, we will here give but little detail to the gathering of your material.

We will assume that you have made the necessary investigation of records and gath-

ered all pertinent instruments that are available. Of course, that is an impossibility, but it is a goal worth shooting at. You have checked the General Land Office for all field notes in the area, original, revised, and patent; cancelled surveys and filings; old county maps, sketch files, rolled sketches, reports, correspondence, etc. You have checked at the old Land District Offices for missing survey field notes. You have looked through the County Surveyor's Records for original and subsequent survey notes and tried to locate the original surveyor's field books. You have gone to the County Clerk and District Clerk offices for deed field notes, subdivisions, partitions, and court judgements.

You have gone into the field and made your survey and search. After a preliminary platting and study of your field work, together with the records, you have gained new ideas for further search and followed the new leads thus obtained. You will probably go back several times to recheck and explore other possibilities, but you are now ready to put things on your map.

You have collected your samples of evidence, such as blocks from trees, pieces of roots, soil samples, etc. You have taken pictures of things the attorney would like the court to see, i.e., monuments, trees, fences, water courses, etc. You have done all the above in full consultation with your attorney. Now you are ready to start preparation of your evidence for presentation.

Before you went into the field you prepared a working sketch, from the original field notes which you had gathered, to use in your survey. You will now probably want to make one to be used in court. It will be made on as large a scale as practical, using lines, lettering, and symbols of sufficient size and weight to be seen by the judge and jury. The sketch will show everything called for in the notes, including the name of the surveyor, the chainman, and the date of the survey.

There may be more than one such sketch to show different constructions, to place emphasis on different features, or enlargements of certain areas to show greater detail. Often when subsequent subdivisions of surveys have been made, a working sketch of the subdivision is prepared to show relationship between the subdivision work and that of the original surveyor. Overlays on foil are sometimes used to advantage to show relationship between different sets of field notes, such as original and subsequent surveys.

On your maps made from records, be sure you know your source in detail, such as, "from field notes of the subdivision of the John Archer Survey made by Jas. Kerr in April, 1876, and recorded in Volume 'B' of Surveyor's Records of Dallas County, Texas." Sometimes these notations may be put on the map.

A map is then prepared showing the result of the field work. Again, it must be drawn so as to be as clear as possible to the court and jury. If a juror cannot understand your map or follow your testimony from it, he soon loses interest and your points are lost to him. To facilitate testifying from the map, it is convenient to have all important points, such as corners, watercourse crossings, etc., marked by a letter or a number of a size to be seen at a distance. Details of important points may be made to a larger scale or shown as insets on the main map. As before, overlays are at times used to advantage.

Be careful about putting on your map anything you cannot authenticate. On a map of field work, show only what you found. In instances where it is necessary to use other sources to fill out the map, advise with your attorney about their use. It can be very embarrassing to you and impressive to the jury for the opposing attorney, on cross examination, to start discrediting portions of your map.

Have your records and other pertinent matter in a form for easy reference. Your attorney will have certified copies of the instruments, maps, etc., that he will introduce, but it is well worth the trouble for your own convenience in discussion with him and for refreshing your own memory.

Have your pictures so labeled or numbered that they may be readily identified by you on the witness stand. For example:

"Exhibit No. 23 is a picture taken at a position 50 feet north of the point indicated as 'B' on the map marked Plaintiff's Exhibit No. 6 with camera facing southeast."

Although much of the above is more applicable to Texas than other States, the fundamental procedures may be followed in general on almost any land boundary lawsuit.

The surveyor and engineer are called on to aid in many types of lawsuits other than land boundary disputes, such as:

Traffic Accidents
Accidents on Company Property
Surface Damage Credited to Operations
Salt Water Damage
Erosion and Flood Damage from Pipe Line Construction, and others too numerous to mention.

As varied as the types of suits are, yet the problems of gathering and presenting evidence of certain fundamental facts and procedures are generally applicable.

Keep in mind that you are not asked to prove or disprove the contention of the parties but to gather physical facts and data and prepare them for presentation. A reconnaissance of the area and a discussion with the attorney should reveal what facts are pertinent and what may be expected of you.

TRAFFIC ACCIDENTS

Time will not permit consideration of the many different kinds of suits but as an example we will consider a traffic accident.

What are some of the physical features which would be more or less basic in preparing a map of the site of the accident? Alignment of the roadway for some distance each way from the point of the accident, profile of centerline, width of right-of-way, width of pavement, width of shoulders, height of metal above shoulders, type of pavement, material in shoulders, ditches, superelevation if on a curve, obstructions to view, highway traffic control signs, guard rails, anything which would contribute to either safety or hazardous conditions. Much may be shown by cross-sections taken at key points. Do not put anything on your map that you do not see. You may show skid marks, but do not label the maps as to whose skid marks they are. You cannot show "point of collision" unless you saw the accident. The attorney will use other witnesses to reconstruct the accident, probably on your map. An additional, larger scale drawing of the immediate area is often desirable.

In some instances it is permissible to get certain data from other sources, such as the Highway Department, but care must be taken to record fully the source and how obtained, as "State Highway Dept., Bridge Section, Map No. A-1234-X dated 4-21-48, obtained from John L. Jones, Asst. Office Engineer, Bridge Section, State Highway Building, Austin, on 5-2-56." It might then be necessary to have Mr. Jones subpoenaed to authenticate the map; therefore, such sources should not be used without the knowledge and permission of your attorney.

The above is intended to give a general idea of the kind of information which may be gathered for different lawsuits, the underlying principal being to obtain everything related and to prepare it for exhibition to the court in the clearest possible manner.

We will now give some thought to and remarks about that for which you have been planning, i.e., the presentation to the court of the data, which you have collected and correlated, through you as a witness.

DIRECT EXAMINATION

You are an expert or you would not have been given the assignment, but the courts do not recognize you as such. Only in rare instances are you asked for or permitted to give an interpretation of the evidence you have assembled or voice an opinion based on same. You are on the witness stand as an instrument for the introduction of certain evidence. You can testify as to its source and nature and, through your attorney's questioning, develop the relationship between certain facts.

Before going on the stand try to anticipate what material you may need in your testimony and have it in convenient form. No one, judge, jury, or attorneys, appreci-

ates delays while you search or fumble for something you should have had available. You may testify from notes, calculations, etc., which you have previously prepared, and you are permitted to refresh your memory on field notes, dates, etc. Have all calculations, which you can anticipate, already made and in convenient form, conversions, distances, areas, or anything about which you might be expected to be asked and about which you cannot read directly from the map or instruments about which you are testifying.

When you are sure you understand the question, answer promptly; long delays create an impression of indecision. Speak clearly so the judge, jury, the attorneys, and the court reporter can understand you. Remember you are testifying not only for those present but also for the record; and nods, signals, etc., cannot be recorded. Never give an indefinite description of a point about which you are testifying. "From here to there" means nothing in the record but "From point 'C' to the bridge 50 feet north of point 'H' on Defendant's Exhibit No. 15" leaves no doubt as to your meaning. If you are asked by one of the attorneys or the court to do something such as place a symbol or line on a map, when you have complied give indication, as "I have done so," for the record.

Be responsive to questions but do not volunteer information. If your attorney wants it told, he will ask for it, and you could be giving the opposing attorney leads he had not thought of. If an objection is made to a question, wait for the court's ruling.

CROSS-EXAMINATION

On cross-examination you may expect the opposing attorney to attempt two things: (1) to discredit that portion of your findings and testimony which is in controversy with his claims, (2) to use your findings and testimony in a manner to his advantage. This should not cause you, as a witness, any concern. You are testifying to facts, and you are testifying in a field with which you are more familiar than he. Let me here emphasize, do not attempt to tell him the law, he knows it better than you. As our ex General Counsel, Walace Hawkins, once advised me, "keep him in your backyard and you have the advantage; if he gets you in his backyard, he has the advantage."

Do not give the appearance of trying to hold back or hide something. Even though it doesn't help your case, if it cannot be avoided, a prompt and normal answer makes less impression on the jury than if he has to force an answer from you. By answering promptly does not mean being so quick as to rob your attorney of the opportunity for an objection.

Do not be antagonistic or too clever. When you lose your temper, you lose some of your judgment, and a funny man is seldom amusing to the court. If you are asked to give a categoric answer to a question when to do so would give a false impression (Have you stopped beating your wife?) you have a right to ask permission to qualify your answer. Your own attorney will be standing by to see that your rights are protected. Make sure that you understand the question before answering, but do not purposely prolong or delay proceedings; to do so will not make you popular with judge or jury.

I find that it relieves tension to look at the jury both collectively and individually; if you have a long stint on the stand, you will get to feel that you know them and feel much more at ease.

Act in a courteous and friendly manner toward opposing attorneys but do not become chummy with them during the trial. Do not permit them to swab you for information off the witness stand except in the presence of and with permission of your attorney. Limit your discussion of the case to those with whom you are working directly. Chance remarks or opinions voiced indiscreetly sometimes find their way to unintended destinations and even take on added meanings in their travel.

The attorney in charge of the case is in command. You have been in on the planning and are a member of the staff. Sometimes his major attack or defense is built around you. You are not there for glory

but to win because you think your side is right. If you think otherwise, then in fairness to yourself and your employer say so at the earliest moment.

I have tried to point out a few things which might be helpful to the uninitiated. Volumes could be written without adequately covering the subject.

₹ ₹ ₹

"$250 Fine for Disturbing"

Our Past President Carroll F. Merriam, now "retired" and living in Prospect Harbor, Maine, contributes now and then to *The Peninsula Gazette,* a small, mimeographed publication issued weekly at Winter Harbor, Maine—Bernice Richmond, Editor. As might be expected, Mr. Merriam's writings usually have a surveying-and-mapping theme. His latest contribution is quoted below, and we wish that many more local papers might use similar material at appropriate intervals.

—EDITOR

"This phrase is seen on little round bronze disks cemented in ledges and set in tops of concrete posts known as survey monuments established by government agencies. These marks have a very important purpose and have been placed at considerable expense primarily because of their value in the future. Damage done by wanton destruction may far exceed the $250 penalty.

Does this mean that a monument should stand in the way of further development of the land? This is a question concerning which I find that there is great misunderstanding. Land owners have been much concerned thinking that they have permanently given up to the government any rights that would interfere with the set marker. This is only true to the extent of a 3¢ card. There is no intent on the part of the government to detract as much as a widow's mite from the value of any land so occupied. All that is necessary to do is to drop a card addressed to the Director of the Agency shown on the marker and steps will be taken to reset a substitute marker in a suitable location. However, and this is more important, all this must be done *before* the original is disturbed in any way. Once it is moved even a fraction of an inch, all is lost and it would be better to have it smashed up altogether than to remain and be misleading to some surveyor in the future.

Prompt action and an investment of 3¢ may save one of the several hundred such monuments destroyed each year.

C. F.M.

₹ ₹ ₹

Automatic Map Compilation System

Accurate map information from aerial photographs in much shorter time than is now required by manual photogrammetric methods is expected from an automatic map compilation system now under development.

The new system is being developed by the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia, by contract with Paul Rosenberg Associates, Mount Vernon, New York. The result of an eight year program in mapping automation by these Laboratories, the prototype automatic map compilation system is scheduled for delivery in mid-1960.

The output of the system will be ground position information for every point imaged in the photography and may be displayed as a contoured photograph in which the position of the image is corrected to its true scale position (contoured orthophotograph). Components of the system include flying spot scanners, a fully transistorized high-speed digital computer, electronic correlation circuitry to match corresponding areas on overlapping photographs and determine relief, and high resolution facsimile equipment to print orthophotographs.

The system operates by scanning electronically conjugate points on the overlapping aerial photographs which represent the intersection of a vertical plane with the surface of the earth. The scanning is controlled by the computer. Deviations in scan required by the correlation circuitry to achieve match, correspond to differences in terrain elevation. Ground elevations are recorded in conjunction with their horizontal positions on magnetic tape. The tape is used as a primary record and can be used to control a print-out device to produce the contoured orthophotograph.

A successful automatic map compilation system has tremendous application in civilian as well as military operation.

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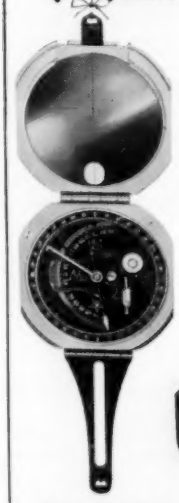

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Temperature Compensation of the Subtense Bar

By PAUL HARTMAN

PROFESSOR OF CIVIL ENGINEERING, THE CITY COLLEGE OF NEW YORK

THE KERN subtense bar has an ingenious temperature compensator which eliminates the need for temperature correction when the ambient temperature differs widely from the temperature at which the bar was calibrated. It is usually assumed that, because the material used to establish the distance between the targets of the subtense bar is invar, there is no need for temperature compensation or correction. This assumption is not correct at extreme temperatures, as will be shown. The functioning of the compensator will also be explained.

The Kern subtense bar without the compensator is shown schematically in Figure 1.

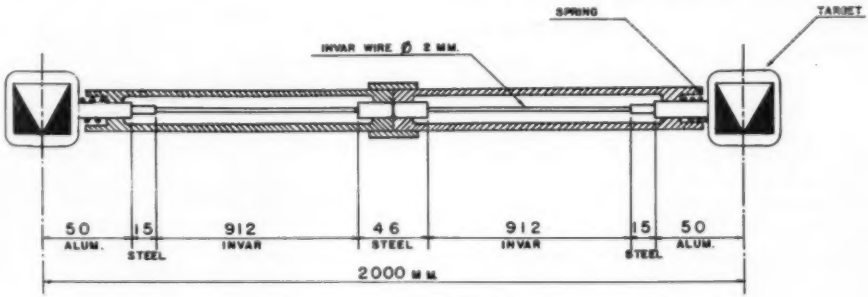

FIGURE 1.

The coefficients of linear expansion of the materials used are:

Invar	0.55×10^{-6} per °F (average value)
Steel	6.5×10^{-6} per °F
Aluminum	13×10^{-6} per °F (an alloy, "Anticorodal")

A decrease in temperature from 68° F, the calibration temperature, to 18° F will decrease the distance between targets by

Invar	$2 \times 912 \times 0.55 \times 10^{-6} \times 50 = 0.0501$ mm.
Steel	$76 \times 6.5 \times 10^{-6} \times 50 = 0.0247$
Aluminum	$100 \times 13 \times 10^{-6} \times 50 = 0.0650$
Total	0.1398 mm.

The drop in temperature decreases the length of the aluminum housing. Each half of the housing will shorten more than the corresponding lengths of invar and steel by

Invar	$912\ (13 - 0.55)\ 10^{-6} \times 50 = 0.567$ mm.
Steel	$38\ (13 - 6.5)\ 10^{-6} \times 50 = 0.012$
Total	0.579 mm.

With a spring constant of 1.6 pounds per mm., the tension in the wire decreases 0.925 pounds. The modulus of elasticity of invar in 34,000 pounds per sq. mm., so the resultant shortening of the wire is

$$\frac{0.925 \times 2 \times 912}{3.14 \times 34{,}000} = 0.0158 \text{ mm.}$$

Thus the distance between targets decreases 0.156 mm. (0.1398 + 0.0158) for 50° drop in temperature. The corresponding error in distance measure is

$$\frac{0.156}{2000} = \frac{1}{12{,}900}$$

Note that this is a systematic error. Furthermore, since the coefficient of expansion of invar can vary from zero to twice the

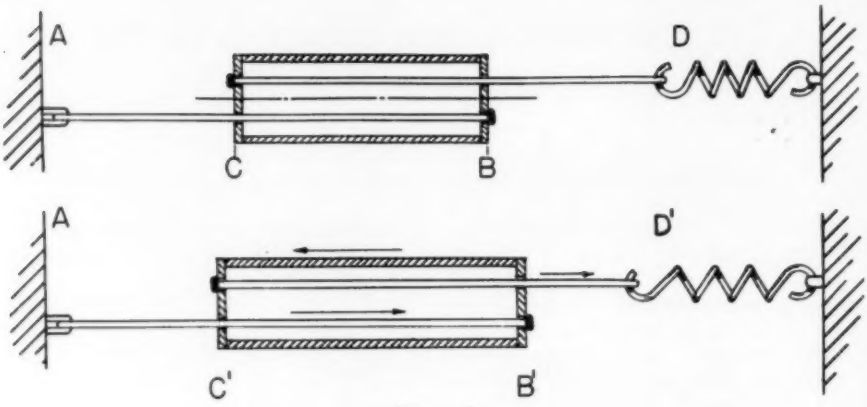

FIGURE 2.

value used in these computations, the distance error could be as large as 1:9765. Distances obtained with an expanded bar will be short.

The temperature compensator, which largely eliminates temperature effects, consists of an aluminum tube. Its operation is shown schematically in Figure 2. The invar wire is fixed at *A* and attached to the aluminum tube at *B*. A second invar wire is attached to the tube at *C* and held at *D* by a spring. If the temperature rises, wire *AB* becomes longer and the right end of the cylinder moves to *B'*. The cylinder, having a larger coefficient of expansion, expands more than the wire and the left end moves to *C'*. The wire *CD* also expands to offset the expansion of the tube.

It may be readily seen that, with given coefficients of expansion, the length of the tube, which will just balance the expansion of the wire, can be computed. The Kern subtense bar with the compensator is shown schematically in Figure 3. For a temperature drop of 50° F, the contraction would be as follows:

Invar	$(912+600+567) \times 0.55 \times 10^{-6} \times 50$	$= 0.0572$ mm.
Steel	$76 \times 6.5 \times 10^{-6} \times 50$	$= 0.0247$
Aluminum	$100 \times 13 \times 10^{-6} \times 50$	$= 0.0650$
Shortening due to decrease in tension		$= 0.0207$ mm.
	Total	$\overline{0.1676}$ mm.

The decrease in the length of the aluminum tube is

$$255 \times 13 \times 10^{-6} \times 50 = 0.1658 \text{ mm.}$$

Therefore, the influence of thermal ex-

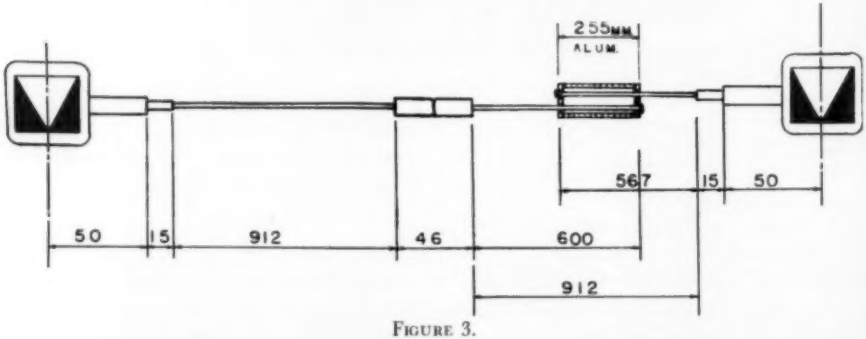

FIGURE 3.

pansion upon the spacing of the targets is fully compensated for all practical purposes, provided the coefficients of expansion used are correct. The only deviation of any importance would exist in the coefficient of the invar. This coefficient can vary from zero to 1.1×10^{-6} per °F. With the compensator, such a variation would result in a change in the spacing of the targets of about 0.055 mm., for a temperature change of 50° F as compared with 0.106 to 0.205 mm., without the compensator.

Converting these figures to the corresponding precision, for a temperature change of 50° F, the compensated bar cannot be in error by more than 1:36,300 whereas the uncompensated bar can be in error by as much as 1:9,750.

VIENNA — 1961
10th Congress of Federation Internationale des Geometres

By GEORGE C. BESTOR

This is "first call" for participants in the Tenth Congress of the Federation Internationale des Geometres to be held in Vienna, Austria, in the early fall of 1961. The American Congress on Surveying and Mapping was accepted into the Federation at the meeting of the Permanent Committee at Krakow, Poland, this year, so the Vienna Congress will be our first opportunity for full participation in the international group.

Now is the time to start planning for this important meeting. ACSM must prepare well, in order that we may participate on such level as to bring credit to our country and our association. And most individuals must plan ahead to be able to take such an important trip.

An ACSM–FIG Committee is in process of formation to maintain ACSM contacts with the international society and to prepare for the 1961 meeting. In addition to such general subcommittees as will handle exhibits, translations, publications, etc., there will be subcommittees specifically charged to maintain contact with each of the Technical Commissions of FIG. The work of these commissions was explained in SURVEYING AND MAPPING, June 1959, Vol. XIX, No. 2, pages 203–210. These commissions are:

Commission I—Technical Dictionary
Commission II—Cadastre and Rural Reallotment
Commission III—Surveying Instruments and Methods, Mapping, Photogrammetry
Commission IV—City Planning and Urban Reallotment
Commission V—Junior Surveyors
Commission VI—Fees, Salaries, and Professional Status
Commission VII—Education

I should like to hear from surveyors and mappers with an interest in actively participating in the ACSM's international activities. I am also most anxious to hear from members with a working knowledge of French, German, Italian, Spanish, or Russian. I hope to see any papers we present to the Vienna meeting published in at least French and German in advance of the meeting. Translation service was made available by the FIG secretariat at the 1958 meeting at Delft, Holland, but so many papers were submitted at the last moment (including mine) that it took colossal effort just to mimeograph late submissions in the original language.

In addition to translation of our papers into other languages, we need linguists who can translate technical papers into English. Much interesting activity is going on in other lands, and we should keep in touch with it. Often this requires fluency in other tongues. Volunteer translators please step forward!

But even if you speak no foreign language and feel no special qualification for committee work; plan on attending the meeting anyway. Vienna is a fascinating city in a beautiful country. The meetings will be instructive and the social gatherings and group excursions most interesting. Your expenses of traveling to and attending a professional meeting are tax deductible. There are many reasons for including the Vienna meeting in any vacation travel plans you may be developing for 1961. *See you in Vienna!*

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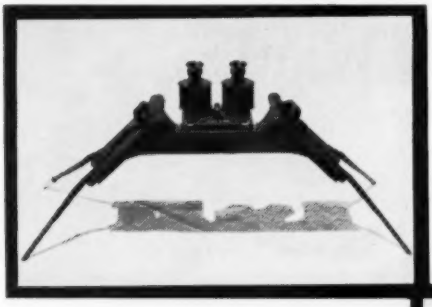

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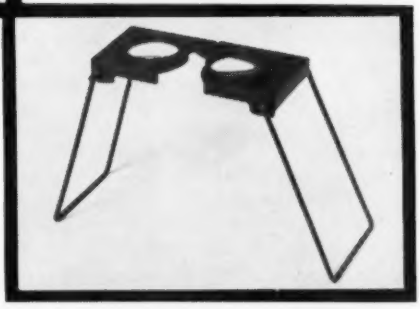

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Guided Missile Geodetic Problems

By COMMANDER ROBERT F. FREITAG

UNITED STATES NAVY

THE FIELD of geodesy and surveying is one that, for the better half of my life, I have merely tolerated. However, of recent times I find that, as a missile and missile range designer, I am daily confronted with problems associated with geodesy, and that many of these problems are unsolved.

Accordingly, it is the purpose of this discussion to tell you about these problems and to lay out the requirements of the job the geodesist must do in order to optimize the achievements of those involved in the development, test, evaluation, and use of modern guided missiles and space vehicles.

The long history of military science has continually imposed new mapping requirements for operations, navigation, and construction. But the introduction of the guided missile, and now the space vehicle, have seen the failure to fulfill the more stringent of these requirements become a severe restriction in the effective employment of these weapons. Therefore, I will attempt to describe those aspects of the guided missile program which create the greatest need or impose the greatest requirements on the field of mapping and surveying.

THE ELEMENTS OF THE PROBLEM

Over and above the stringency of the missile mapping requirements, there is the additional problem of scope, for vast quantities of data are involved. Worldwide operations are envisioned, in every element of the earth—undersea, on the land areas of the earth, and in the heavens, including a great new exploration and mapping of the stars, particularly the radio stars and the daylight-visible stars.

The problems of tying together the many geodetic datums so that missile flights can be accurately made between these datums, together with the improvement of geodetic information within the world's datums, are of particular significance. I refer not only to positional information within the datum, but to the other elements of reference, including accurate determination of the local vertical; the determination of the character of the magnetic field, particularly anomalies and deviations; the recording of special terrain features and characteristics useful in establishing target references; and the establishment of the true geoid. Many other earth characteristics might need to be studied and measured, such as the ocean currents that would affect the launching of a missile like the *Polaris,* or radio-wave propagation anomalies caused by atmospheric conditions, or meteorological features like the jet streams or the "Sierra Wave" which could influence missile flight paths. These latter items may be somewhat afield from surveying and mapping, but must be intimately considered in the broad study of the problem.

General knowledge of the guided missile problem is well publicized. The seeming glamor and great public fascination associated with the expected accomplishments of missiles and space vehicles has led to a common misconception that all we have to do is build the vehicle, launch it, and have it rush to the target with unerring accuracy. There are two additional and difficult problems: exactly where were we when we launched the missile and exactly where is the target located!

TYPES OF MISSILES

The general types of missiles that are be-

Presented at the Annual Joint Meeting of the Northern and Southern California Sections of the American Congress on Surveying and Mapping, Santa Barbara, California, May 2–3, 1958.

No objection is raised to publication on grounds of military security by the Office of Security Review (OASD L&PA), Department of Defense.

ing developed should be described. First, there are those that perform a mission wherein there is a directly determinable relationship between the launch point and the target, between the launch point and the missile, or between the missile and the target, such as air-to-air, surface-to-air, or air-to-surface missiles. For these types of missiles, the geodetic problem is avoided since the guidance reference is usually some form of direct tracking-radar, heat-homing, acoustic-homing, or the like. Sometimes, however, there is a local geodetic problem. This would occur with a surface-to-air anti-aircraft missile system which would employ centralized radar tracking stations with remote missile launch sites. In this case, accurate transfer of target vector information from the tracking to the launch site is most essential. However, to date, this has been a solvable problem though ever-increasing in intensity. With newer weapon systems of this type, such as an anti-ICBM missile, the problem becomes most challenging.

The second main category of missiles, and those wherein surveying and mapping requirements are most critical, are the surface-to-surface types (or very long range air-to-surface types) where firing between two points on or above the earth's surface is involved, either with or without intermediate terrain or astronautical reference points. These are the ballistic rockets, the satellites, the aircraft-like missiles of the *Regulus, Matador, Snark,* and *Navaho* types, the spatial and interplanetary vehicles of the future. These missiles employ many types of guidance systems which, because of security, cannot be described fully. However, the principles of operation are well known, and it is these principles that delineate the geodetic problem. A few of these systems are described.

MISSILE GUIDANCE SYSTEMS

Inertial Guidance System.—A launch point reference is placed in the missile by aligning a stable platform within the missile to the local vertical and local north. After inserting the target data, also in terms of vertical and position, the missile can be directed to fly between the points. A system of precision accelerometers mounted on the stable platform sense deviations from this precomputed flight path and issue commands that control the flight of the missile, including steering commands, propulsion orders, and firing signals.

Map-Matching Systems.—There are a series of guidance systems that involve direct terrain reference. The reference might be either a radar picture of terrain as measured from within the missile, an optical system, or an infra-red system. By controlling with relation to a known and accurately mapped site, missile guidance can be effected.

Similarly, by the use of automatic star-trackers within missiles the guidance can be accomplished by using, among other things, accurate celestial reference maps of the launch and target areas and a built-in knowledge of the vertical.

Lastly, magnetic reference and flight guidance systems based on known magnetic variations and anomalies can be used.

OPERATIONAL CONSIDERATIONS

The operational considerations are also of great significance. The employment of missiles must, of necessity, be worldwide. The reference data must be immediately available. In many cases, particularly with operations from Navy ships and submarines, the information must be dynamic and continually determined from a moving platform. In a particularly difficult case, this must be determined on the open seas while underway and fully submerged.

EXAMPLES OF PROBLEMS

The specific requirements for geodetic data are extensive and cannot be treated in detail here. However, examples of certain critical problems can point up the situation. Consider, for example, a 5,500-mile intercontinental ballistic missile. Such a missile might fly from a point in the center of the United States to a predetermined point in Asia. Assuming that it will fly at about 23,000 feet per second, its rockets and guidance system must control its speed to a very few feet per second. It must know its reference to the local vertical along the path

and its azimuth to true north to within a few seconds or minutes of arc. The guidance system operates on these data and on second-order variations such as the variation of the acceleration of gravity at hundreds or thousands of miles above the earth's surface and the variation of shape of the geoid.

The basic geodetic requirements become even more critical when the research, development, and test considerations are inserted. Missiles are developed and tested at any of our several guided missile ranges such as the Atlantic Missile Range at Cape Canaveral, Florida, or here at the Pacific Missile Range in Southern California, for example. On these ranges, the geodetic considerations are even more critical. On the range we need to measure the errors and variations of the systems and employ measurements of an order of magnitude more accurate than we use operationally. For example, at the Pacific Missile Range the most advanced techniques known are being used to tie together the launch sites, the radar tracking sites, the optical tracking sites, and the acoustic tracking sites. Multiple surveying and position-determining systems—electronic, optical, geodetic, and inertial—are used to provide the required references. Typical problems we face are:

1. How accurate are astronomic observations on some unsurveyed island in the Pacific Ocean with respect to the North American Datum?

2. Should the coast of California be referred to some datum other than the North American Datum in order that points in the Pacific may be properly related to the California coast?

3. Should some reference spheroid other than the Clarke 1866 be used for the Pacific and its American coast line? Should we change practice to the International spheroid used operationally?

4. How accurately, without resorting to extensive gravity measurements, can the local vertical be estimated in a point which has been located by astronomic methods?

5. Does the deflection of the vertical due to local topographic conditions diminish as the missile ascends to a high altitude?

Likewise, in addition to those for guidance operations, we have mapping requirements for support and instrumentation functions. Mathematical methods are available for calculating bearing and geodetic distance from a missile launch point to a target point, given the correct latitude and longitude of these points referred to the correct spheroid. However, for tracking purposes, maps of the area involved are almost indispensable for obtaining information on range, for surveillance and missile acquisition, and for studying missile behavior. Maps would be desirable that are sufficiently accurate without resorting to mathematical computations involving scale factor and bearing corrections. We need to know how accurate are the La Borde, oblique Mercator, transverse Mercator and Lambert map projections over ranges of three or four thousand miles and, say, one hundred miles off range. Other miscellaneous questions are, for example, what three-dimensional rectangular coordinate systems available are more serviceable for tracking long range missiles than the so-called geocentric system and, what is the best and most useful presentation of the earth's gravity field? Reports have been written describing this field in empty space and others for points in the atmosphere close to the earth. What is the description that considers both cases?

THE FUTURE

These questions and these problems all involve immediate application today. What the future holds is even more dynamic. The advent of the satellite provides, initially, some of the most stringent mapping requirements we face. But this is a two-edged sword for, at the same time, it offers great promise of being the greatest tool we have ever known for world-wide surveying, a tool for tying all world datums to a single reference, for total determination of the true spheroid, and for full determination of gravitational, magnetic, and other anomalies. The satellite, as a reconnaissance system and artificial reference, or a communication system, seems to open our greatest vistas in the surveying and mapping art.

Already, with the primitive satellites we now have in orbit, we are able to apply corrections to our knowledge of the geoid and our world maps.

The Tellurometer Now Has Two Brothers

A major advance in electronic surveying was announced in Washington, D. C., October 22, 1959, when Colonel Floyd W. Hough, in speaking at a meeting of the Surveying and Mapping Division of the American Society of Civil Engineers, introduced two new micro-wave systems designed to crack distance-determination problems heretofore extremely difficult.

One of the new techniques is expected to step up hydrographic work, offshore oil exploration, river dredging, and other land-to-water operations where precise location of a moving vessel is required. The other will enable surveyors to carry horizontal control across bodies of water or areas of inaccessible terrain, 40 to 150 miles wide, in one leap.

The latter, the "Aero-Dist," is an air-to-land system with which surveyors will be able to take to the air to measure distances difficult or impossible to obtain on the ground.

The system is composed of a master unit, carried by a light plane or helicopter, and two (or more) remote units on the ground. The theory of their operation is simple: Assume an area of inaccessible or heavily forested terrain up to 150 miles wide, across which a survey line must be carried. A remote unit would be set up at each edge of the area. The airborne master unit flown across the line between the two nonintervisible stations would transmit microwaves continuously and simultaneously to the two remote units. The series of measurements to each would automatically be recorded on the master unit and the shortest distance between the two ground stations determined by simple computations.

Another potential use would be to maintain a continuous record of the exact location of a plane taking aerial photographs. This would be of considerable value to the photogrammetrists.

The manufacturer anticipates that the "Aero-Dist" will be utilized to carry traverse across areas heretofore difficult or costly to penetrate on the ground.

A triplex system has also been developed utilizing three ground units. This would permit surveyors to establish two or three entirely new positions in relation to each other, or a third position in relation to two existing positions. The value of this application would be in extending existing horizontal control. This technique is actually a system of trilateration from the air, inasmuch as it involves the measurement of the distances between points (or sides of a triangle), with proper allowance for the different elevations of the plane and ground stations.

The "Aero-Dist" has been designed to produce an accuracy of 1 part in 100,000, plus-or-minus one meter.

The other electronic distance-determination system making its debut with the "Aero-Dist" is the "Hydro-Dist." The latter is a land-to-water system designed to measure lines across water, particularly for positioning of off-shore oil explorations or determining a "fix" for a survey vessel.

The land-to-water system operates on much the same principle as the now familar Tellurometer system, introduced two years ago, with innovations designed to overcome the unique problems involved in locating a moving vessel. A series of radio impulses are transmitted from a master unit aboard the vessel, received by the remote units and retransmitted. The time it takes the microwaves to make the round trip is determined at the master unit, and automatically translated, or "read out," in meters, as the vessel moves along.

The manufacturer expects that "Hydro-Dist" techniques will to a considerable extent replace the sextant-angle procedures used in hydrographic surveying. The chief advantage of the microwave system is that it can be utilized through fog or rain and day or night.

A semipermanent installation could be used by engineers concerned with keeping a dredge on course in a river or harbor. Remote units on shore could be installed to provide continuous location data to the dredge. Operators would not be required to man the shore stations, and inclement weather or darkness would not hamper the system.

The "Hydro-Dist" has been designed for an accuracy of about a meter, within a 25-mile range.

These look like two very husky brothers.

Rockets, Satellites, and Geodesy

By Dr. R. W. PORTER

GENERAL ELECTRIC COMPANY

Editor's Note.—The following is a portion of the remarks made by Dr. R. W. Porter at the National Rivers and Harbors Congress Panel Discussion of Weather Modification and Space Exploration, Washington, D. C., May 15, 1959. Only the part of this paper which relates to the geodetic uses of rockets and satellites has been reproduced. The section on meteorology has been omitted.

INTRODUCTION

A first step toward the exploration of space has now been taken by mankind in the form of high altitude sounding rockets which carry his instruments well beyond the earth's atmosphere for brief periods of time, and earth satellites which can sustain instrumentation packages at distances all the way from the upper fringes of the ionosphere out to many times the earth's radius. One of the major scientific achievements during the I.G.Y., which could not have been accomplished without the use of rockets or satellites, was the discovery of the presence of intense zones of radiation in the vicinity of the earth which consist of rapidly moving charged particles, trapped in the earth's magnetic field. This type of radiation is sometimes referred to as Van Allen Radiation after Dr. James Van Allen of the State University of Iowa, under whose direction the instruments carried by the first U. S. satellite were designed and constructed, and who first provided the correct interpretation of the rather startling measurements transmitted back. Rocket and satellite experiments made during the I.G.Y. also provided additional data concerning the meteoric dust which pours into the earth's atmosphere by the thousands of tons per year. They made possible significant refinements of our knowledge and understanding of the ionosphere and the fluctuations of the earth's magnetic field and especially of their relationship to the great solar disturbances which occurred frequently during the I.G.Y., and they contributed to a better understanding of the interrelation of all these effects with variations in the intensity of cosmic rays, best described as "stripped-down," "hot-rod" atomic nuclei that seemed to come mostly from the very deep reaches of space outside our galaxy.

A Russian satellite apparently demonstrated the ability of highly organized forms of life, such as a dog, to endure and function effectively for long periods of time without the normal acceleration of gravity. The rather crude space probes successfully launched by both the U.S.A. and the U.S.S.R. during this period proved our ability to escape the earth's gravitational field and yielded invaluable knowledge about the radiation environment and the magnetic field at greater distances from the earth.

Important though these results may be, the rocket and satellite experiments conducted during the I.G.Y. are only a beginning. Plans for the next few years will carry the work much further, and it is difficult to talk about the decade ahead without sounding like science fiction. It is my intention today, however, to limit my remarks to the existing and potential use of earth satellites for scientific experiments in the fields of geodesy and meteorology.

GEODESY

Geodesy is primarily concerned with measuring the size and shape of the earth and deducing from these parameters some facts about the physical structure of the earth. One could theoretically achieve these objectives by carrying out a high precision survey connecting selected points all over the earth's surface. If it could actually be carried out, this process would result in a "map" of the earth's surface as a many faceted polygon, approximating a spherical figure. The points of the figure, of course, would not be at the same level.

The first complication of geodesy is introduced by this word "level." It implies the existence of a reference figure whose surface is all "at the same level," that is, one which is everywhere perpendicular to the combined force of gravity and the centrifugal force arising from the earth's rotation. Two prominent geodesists, Heiskanen and Meniesz in their book—*The Earth and Its Gravity Field*—divided the history of geodesy into three periods according to the shape of the reference figure in current use. The first period was the spherical era dating from around the 3rd Century B.C. The second or ellipsoidal era began with Newton and merged finally with the 3rd or geoidal era of this century.

The geoid is defined as the equipotential surface of the earth's gravitational field at sea level. It is a somewhat wavy or bumpy surface that approximates a mean ellipsoid, the deviation from it being not more than 50 meters upward or downward. For convenience, the location of the geoid is specified by its height above or below the ellipsoid as a function of spherical coordinates. Although the geoid is simple in concept, and although you can actually see it at the seashore, it is quite another matter to tell its actual location with respect to the ellipsoid, or any other standard coordinate system, in mid-ocean where there are no triangulation points, or to trace its position under the surface of continents.

Among the principle problems of geodesy to which the use of earth satellites can contribute are the following:

1. The tying together of widely separated geodetic datums.
2. Fixing the various datums with respect to the gravitational center of the earth.
3. Determination of the shape and size of the earth.
4. Determination of the gravity field of the earth, both broadly and in detail.

Perhaps the most straightforward way in which satellites may be used is as a moving triangulation point whose coordinates with respect to each separate geodetic datum may be observed more or less simultaneously. It should be noted perhaps that high altitude rockets can also be used for this purpose, and also have a slight advantage in that they do not move so rapidly, with respect to the earth's surface. However, a single satellite may be used for many repeated observations, thus improving the precision of the observations to any desired extent, whereas the rocket can be used at best for only a small number of observations. A satellite can be observed and photgraphed against a star background during twilight periods, as was done during the I.G.Y., or it can carry a suitably instrumented flashing light, as has been suggested by a number of people, which will aid in identifying corresponding observations and have the obvious additional advantage that it can be observed at any time during the night. The addition of some sort of precise radar ranging system would, of course, greatly strengthen the fixing of the three dimensional position of a satellite by methods which essentially amount to trilateration.

By an extension of these methods it should be possible to determine the displacement of the geoid from the reference ellipsoid at any desired spot on the earth's surface. This could be accomplished, at least theoretically, by determining the space coordinates of a ground station by precise observations, or back sights, of a satellite whose position is precisely known in a coordinate system defined by a minimum of three standard stations. If the field station is also connected by a geodetic net and precise leveling to the same three standard stations, then its known geodetic coordinates can be compared with its space coordinates to yield the desired transformation from the ellipsoid to the geoid. This procedure will of course demand observations of the highest possible accuracy inasmuch as the geoid height probably does not exceed 50 meters.

One of the most effective ways in which an earth satellite can be used in geodesy is by careful observation of the perturbations of its orbit. If the effect of the earth's atmosphere can be eliminated, either by selecting an orbit far enough away from the earth to make the effects negligible or by

applying appropriate corrections, and the gravitation influences of the sun, moon, and other planets are either corrected for or found to be negligible, it is possible to derive exact mathematical relationships between the motion of the satellite and the earth's gravitational field expressed in spherical harmonics. Thus by careful measurements of a satellite orbit, it is possible to determine the deviation of the geoid from a sphere. This procedure has actually been carried out using the tiny Vanguard test sphere known as 1958 Beta or Vanguard I. One of the startling results of this analysis is the discovery of a third zonal harmonic in the earth's gravitational field having an amplitude on the order of .0047 cm/sec^2. This gravity variation implies some 15 meters of undulation in the geoid, or mean sea level shape of the earth, in the form of a 15 meter rise at the North Pole, 15 meters of additional flattening at the South Pole and flattening of the order of 7½ meters in the middle latitudes of the Northern Hemisphere balanced by an equivalent bulging in the middle latitudes of the Southern Hemisphere. Thus the shape has been referred to in the newspapers as somewhat resembling that of a pear.

This finding is in conflict with the basic hypothesis of geodesy of Heiskanen and Meniesz which assumes that the earth's gravitational field closely approximates that of a fluid in equilibrium and that deviation from such an ellipsoid may not exceed .0030 cm/sec^2 over an area one thousand kilometers on a side, a number sometimes referred to as 30 milligals per square megameter. According to 1958 Beta, however, each of the polar areas has a deviation of about 120 milligals per square megameter and each of the equatorial belts deviate more than twice as much. Hence there must be a very substantial force acting on the surface of earth which would create stresses down to the core of the earth, which implies that the core is solid rather than liquid, or alternatively requires the assumption of stresses in the crust and mantel beyond the mechanical strength this material is usually assumed to have. Another alternative explanation might be large-scale convection currents in the interior of the earth. In any case, I think you will agree that the geodetic value of this minimum satellite has been very great indeed.

CONCLUSION

It might well be asked why space vehicles should be used to study the earth; one might expect perhaps that space research would more probably be directed toward the planets or the stars. However, at the present state of our technology it seems to be easier for us to send our instruments far out into space than it is to penetrate deep into the crust of the earth. Therefore, if we want to learn more about the inside of the earth, paradoxically, we must send our instruments out in a satellite in order to gain the synoptic information about the earth's gravitational field from which we can deduce what we would like to know about the interior of the earth. Furthermore it is apparent that the disturbances of the earth's atmosphere which we call weather are caused by external effects, primarily the radiant energy from the sun. What better means could we find for measuring these external effects on a synoptic basis than the earth satellite? In fact, as we look more closely, it appears that most of the questions posed by space science affect the earth and its inhabitants in an important way. A few such questions are: How old is the earth, the sun, the galaxy, the universe? How were they created? What is happening to them? Is there other life in the Universe? How did life come into being? I think you will agree that scientific explorations into space, like those into the nucleus of the atom are not only of interest or concern to a few scientists, engineers, or military experts, but rather to all of us who live on earth because they can so profoundly affect our lives and our thinking.

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Surveying and Mapping Literature

Members are requested to send in surveying and mapping news items for publication in SURVEYING AND MAPPING.—EDITOR.

MAGAZINE ARTICLES

General Interest

THE DETERMINATION OF UNIVERSAL TIME AND EPHEMERIS TIME. H. J. M. Abraham. *Cartography* (Journal of the Australian Institute of Cartographers), Vol. 2, No. 4, September 1958. (Notes the many advantages and limitations of universal time and reports a new unit to be designated ephemeris time.)

NEEDED: NEW VELOCITY MEASUREMENT UNIT FOR SPACE. Major William C. Mannix, USAF. *Missiles and Rockets,* Vol. 5, No. 17, April 27, 1959. (Author suggests the term "Optik" for measurement based on speed of light and compares it to other units of measurement. Endorsed by editorial in same issue.)

OCEANOGRAPHY — THE SCIENCE OF THE OCEANS. *American Scientist,* Vol. 47, No. 2, June 1959. (Abstract from Chapter I, Introduction and Summary of Recommendations of the Committee on Oceanography, National Academy of Sciences–National Research Council.)

GLEN CANYON DAM—TEN-MILLION-DOLLAR CONSTRUCTION PLANT. Joseph Peraino. *Civil Engineering,* Vol. 29, No. 6, June 1959. (Description of preliminary work and equipment at location of a most difficult construction job.)

THE EARLY AMERICAN ENGINEER—TWO MEN IN ONE. Daniel H. Calhoun. *Civil Engineering,* Vol. 29, No. 6, June 1959. (Historical discussion based on Mr. Calhoun's forthcoming book, "The American Civil Engineer: Origins and Conflict.")

LAND RUSH AT THE OPENING OF THE CHEROKEE OUTLET. Portion of Annual Report of General Land Office Commissioner, S. W. Lamoreux for Fiscal Year 1894. *Our Public Lands,* Vol. 9, No. 1, July 1959. (Historical data illustrated with contemporary photographs.)

THE CONSERVATION JOB—EDUCATION—ACCESS TO PUBLIC LANDS. Edward Woozley. *Our Public Lands,* Vol. 9, No. 1, July 1959. (Address by the Director, Bureau of Land Management at 1959 Conservation Week, Utah State University.)

SURVEY SAFETY. A. K. Goldin. *California Highways and Public Works,* Vol. 39, Nos. 7–8, July–August, 1959. (Outlines correct practices for highway survey crews.)

THE CIVIL ENGINEER IN FICTION. Samuel C. Florman. *Civil Engineering,* Vol. 29, No. 8, August 1959. (Author names and discusses an impressive list of novels and short stories in which engineers and surveyors are principal or leading characters.)

POUNDS OR GRAMS? Ralph Segman. *Science News Letter,* Vol. 76, No. 7, August 15, 1959. (Further discussion of the relative merits of the English-American system of weights and measures and the metric system, with note on progress of universal adoption of the metric system.)

LAUNCHING, USC&GS "SURVEYOR." *Marine News,* Vol. 46, No. 3, September 1959. (Physical description of newest addition to Coast and Geodetic Survey fleet of surveying ships and the largest steam turbine propelled ship to be constructed in the San Diego area.)

WHY INDUSTRIAL SUBDIVISIONS. P. J. Schmidt. *Lawyers Title News,* Vol. 14, No. 9, September 1959. (Discusses sensational trend toward diffusion of industry throughout the country, called by a leading manufacturing official "The Second Industrial Revolution.")

ARCTIC DRIFTING STATION. Louis O. Quam. *Transactions, American Geophysical Union,* Vol. 40, No. 3, September 1959. (Brief review of past Soviet and U. S. occupation of arctic ice islands and ice floes, and an account of the establishment of Station C on a selected floe by a U. S. party sponsored by several agencies to conduct scientific observations during the 1959 season.)

THE ROLE OF RADAR IN SPACE RESEARCH. K. J. Craig, A. Shapiro, and B. S. Yaplee. *Naval Research Reviews,* September 1959. (Describes recent progress in radar astronomy.)

Cartography

THE ADMIRALTY CHART. *The Journal of the Institute of Navigation,* Vol. 12, No. 2, April 1959. (A discussion among members of the Institute bringing out both criticisms and replies to criticisms.)

REPORT ON CARTOGRRAPHY. Brigadier E. D.

Baldock, Chief Cartographer, Department of Mines and Technical Surveys, Ottawa. *The Canadian Surveyor,* Vol. 14, No. 9, (Annual Report) August 1959. (Report on Second International Conference on Cartography, sponsored by Rand McNally Company at Northwestern University, June 15–21, 1958.)

AUTOMATION AND CARTOGRAPHY. Waldo E. Tobler. *Geographical Review,* Vol. 49, No. 4, October 1959. (Discussion of the possibilities of the use of computing machinery in cartography.)

Control Surveys

DETERMINATION OF APPROXIMATE DISTANCE BETWEEN TELLUROMETER STATIONS. E. T. Homewood. *Cartography* (Journal of the Australian Institute of Cartographers), Vol. 2, No. 4, September 1958. (Method of obtaining preliminary approximate distances in order to determine the first figure of the coarse number found from the Tellurometer observations.)

AN ELECTRONIC BREAK-THROUGH IN SURVEYING. E. J. Jones. *Civil Engineering,* Vol. 29, No. 7, July 1959. (Description of use of Tellurometer in rugged Canadian terrain.)

COMPUTATIONS OF GROUND CONTROL FOR AIR SURVEYS AT LARGE SCALES. C. W. B. King. *Empire Survey Review,* Vol. 15, No. 113, July 1959. (Illustrated description of procedures.)

Education

EARTH SCIENCE CENTER AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY. Robert R. Schrock. *Transactions, American Geophysical Union,* Vol. 40, No. 2, June 1959. (Review of the organization and progress of the center.)

THAYER OF WEST POINT FAME: HIS PUPILS SET THE PACE. Col. R. Ernest DuPuy. *Army-Navy-Air Force Register & Defense Times,* Vol. 80, No. 4153, July 11, 1959. (Review of the career of Sylvanus Thayer who put the U. S. Military Academy on a firm foundation and was largely responsible for introducing technological and engineering education in this country.)

Instruments

THE USE OF LIGHT FOR MEASURING DISTANCE. K. D. Froome. *Tijdschrift voor Kadaster en Landmeetkunde,* 75e jaargang, Nr. 3, 1 Juni 1959. (Discussion, in English, of interferometry and description of instruments employed.)

CALIBRATION OF PRECISE LEVELLING STAFFS BY A PROCEDURE INVOLVING THE RANDOM SELECTION OF INTERVALS. E. G. Thwaite. *Empire Survey Review,* Vol. 15, No. 113, July, 1959. (Offers mathematical formulae for suggested method of calibration.)

FIELD TEST WITH WALLACE AND TIERNAN ALTIMETERS NEAR MOSHI, TANGANYIKA. P. Hartog. *Empire Survey Review,* Vol. 15, No. 113, July 1959. (Discussion of procedures and report on results of experiments.)

HENRY WILD AND DEVELOPMENT IN THE DESIGN AND CONSTRUCTION OF MODERN GEODETIC INSTRUMENTS. Henry Wild, Jr. *Empire Survey Review,* Vol. 15, No. 113, July 1959. (Brief account of innovations applied by Wild to construction of various geodetic instruments since the turn of the century.)

WHAT'S NEW IN SURVEYING INSTRUMENTS. Roland H. Moore. *Civil Engineering,* Vol. 29, No. 8, August 1959. (Illustrated discussion of a wide range of field instruments, computing devices, and photogrammetric plotting instruments.)

Property Surveys

THE NOVA SCOTIA LAND SURVEY INSTITUTE. W. D. Mills. *The Canadian Surveyor,* Vol. 14, No. 8, July 1959. (Description of organization.)

SURVEYING FOR THE OIL INDUSTRY. J. W. Hill. *The Canadian Surveyor,* Vol. 14, No. 8, July 1959. (General review of the subject of oil-lease surveys in Canada, with a little historical background.)

THE ROLE OF THE QUANTITY SURVEYOR DURING THE DESIGN STAGE. James Nisbet. *The Chartered Surveyor,* (The Journal of the Royal Institution of Chartered Surveyors), Vol. 92, No. 1, July 1959. (Discussion of factors which have emphasized the importance of participation by the quantity surveyor during the design stage.)

USE OF PHOTOGRAMMETRY ON A LEGAL SURVEY. D. R. Slessor. *The Canadian Surveyor,* Vol. 14, No. 8, July 1959. (Comparison of methods and costs of ground surveys and photogrammetric surveys on a special project.)

USE OF PHOTOGRAMMETRY IN THE LEGAL PROJECT AT ALNWYCK. T. J. Blachut. *The Canadian Surveyor,* Vol. 14, No. 8, July 1959. (An alternative point of view on the result of the comparative survey described in the paper by D. R. Slosser noted above.)

THE ROLE OF THE SURVEYOR IN TOWN PLANNING. P. A. Monaghan. *The Canadian Surveyor,* Vol. 14, No. 8, July 1959. (Discusses the functions of preparing topographic maps, boundary surveys, and final plans of subdivision.)

BOOKS AND PAMPHLETS

ARIZONA, BOARD OF TECHNICAL REGISTRATION FOR ARCHITECTS, ENGINEERS, LAND SURVEYORS, AND ASSAYERS. 37th Annual Report for the period Jan. 1, 1958, to Dec. 31, 1958. Phoenix, 1959. 119 pp.

ARKANSAS, BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS. Roster of registered professional engineers, 1959. Little Rock, 1959, 70 pp.

DISTRICT OF COLUMBIA, BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS. SUPPLEMENTAL ROSTER FROM MAR. 1, 1958, TO MAR. 15, 1959. Washington, 1959. 14 pp.

FLORIDA, BOARD OF ENGINEER EXAMINERS, YEARBOOK, 1959. Gainesville, 1959. 143 pp.

IOWA, BOARD OF ENGINEERING EXAMINERS, REPORT FOR THE YEAR 1958. Des Moines, 1959. 124 pp., illus.

LOUISIANA, YEAR BOOK OF REGISTERED PROFESSIONAL ENGINEERS AND LAND SUREYORS, 1959. Board of Registration for Professional Engineers and Land Surveyors, New Orleans, 1959. 134 pp.

MINNESOTA, BOARD OF REGISTRATION FOR ARCHITECTS, ENGINEERS, AND LAND SURVEYORS. Roster of registered architects, engineers, and land surveyors, 1959. St. Paul, 1959. 77 pp.

NEBRASKA, BOARD OF EXAMINERS FOR PROFESSIONAL ENGINEERS AND ARCHITECTS. 21st Annual Report for the period Jan. 1, 1958, to Dec. 31, 1958. Lincoln, 1959. 63 pp.

TENNESSEE, BOARD OF ARCHITECTURAL AND ENGINEERING EXAMINERS, ROSTER, 1959. Nashville, 1959. 186 pp.

SOIL MECHANICS AND EARTH STRUCTURES. Bureau of Yards and Docks, U. S. Navy, February 1959. 146 pp. (Order PB 151613 from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. $2.75.)

STUDY OF DEEP SOIL STABILIZATION BY VERTICAL SAND DRAINS. Moran, Proctor, Mueser, and Rutledge for Bureau of Yards and Docks, U. S. Navy. June 1959. 468 pp. (Order PB 151692 from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. $6.00.)

REPORT OF THE LANDS SERVICE, YEAR ENDED DECEMBER 31ST, 1958. Province of British Columbia, Department of Lands and Forests, Victoria, 1959. 96 pp., illus., tables, maps.

SURVEY OF KENYA, ADMINISTRATIVE REPORT, 1959. Nairobi, Colony and Protectorate of Kenya, 1959. 6 pp., progress maps.

NEW ZEALAND, DEPARTMENT OF LANDS AND SURVEY, ANNUAL REPORT ON SURVEYS, 1959. Wellington, 1959. 24 pp.

PLANE COORDINATE INTERSECTION TABLES FOR THE STATE OF GEORGIA (2½ Minute). Coast and Geodetic Survey Publication No. 65-1, Part 9. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $0.55.)

AGRARIAN REFORM LAW. Cuba, Ministerio de Estado, Departamento de Prensa, Boletin Num. 49. (In English.) La Habana, 20 de julio de 1959, Ano de la Liberacion. 23 pp., mimeographed.

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Coast and Geodetic Survey.

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Change in Secretaryship of the Royal Institution of Chartered Surveyors

A major event in the affairs of The Royal Institution of Chartered Surveyors of Great Britain during the 1958–1959 session has been the retirement of Sir Alexander Killick, C.B.E., D.S.O., M.C., M.A., from the Secretaryship of the R.I.C.S., and his succession on April 1, 1959, by Rear Admiral P. W. Burnett, C.B., D.S.O., D.S.C. (A biographical note of the new Secretary appeared in *The Chartered Surveyor* for March 1959.)

Sir Alexander Killick was appointed Secretary in 1932 and has served the Institution with great distinction, loyalty, and unfailing courtesy for 27 years during which there was amazing growth in membership and advancement of status of the Institution. In testimonial he was presented an illuminated and framed record of the Council's resolution of great appreciation for distinguished services. His portrait by Mr. Norman Hepple, A.R.A., R.P., was commissioned by the Council. In March 1959, Sir Alexander Killick was unanimously elected an Honorary Member of the Institution.

Abstracted from the August 1959 issue of *The Chartered Surveyor* and *The 91st Annual Report of the Council* (R.I.C.S.) 1958–1959 session.

—WALTER S. DIX

Distinctive Recent Maps

The Bureau of Land Management (U.S. Department of the Interior), published in 1958 a *Land Classification Map of the Little Missouri River Basin*. The scale is approximately 1:130,000 and the dimensions of the map sheet are 41 by 56 inches. The map shows vegetation, range condition, recommended stocking rate, range site, and land use capability, based on classification formulas. The area mapped includes southwestern North Dakota, northwestern South Dakota, southeastern Montana, and northeastern Wyoming.

The 350th Hudson Champlain Celebration has inspired the publication of tourist and historic maps of New York State. The historic waterways are featured on *Map-Directory of Navigable Waterways* published in 1959 by the State's Commission of Historic Observances. Supplementing the information on the map is a descriptive essay by Francis P. Kimball entitled "New York State's Waterways are Roads of Romance." On the verso is information about the New York State Barge Canal System and its predecessor the Erie Canal.

Mineral Industries and Resources of Virginia is a cartographic inventory of the resources of the Old Dominion State. The map measures 28 by 58 inches and is at the scale of 1:500,000. It was published in 1959 by the Division of Mineral Resources, Commonwealth of Virginia, Charlottesville. Lithography is by Williams and Heintz of Washington, D.C.

A noteworthy addition to the growing list of State geology maps is the new *Geologic Map of North Carolina*. The map at the scale of 1:500,000, was compiled under the direction of Jasper L. Stuckey, State Geologist, and published in 1958 by North Carolina Department of Conservation and Development. Accompanying the map is a 51 page descriptive booklet prepared by Mr. Stuckey and Stephen G. Conrad. They note that the map "is not a final summary of the Geology of North Carolina but a progress report in which an attempt has been made to present the best information available." The booklet includes a bibliography of some 80 references relating to the geology of North Carolina.

Among the especially welcome cartographic publications of the U.S. Geological Survey are the increasing number of colorful and attractive shaded relief maps of scenic and recreation centers. A recent acquisition in this series is the *Topographic Map of Isle Royale National Park, Keweenaw County, Michigan*. It is at the scale of 1:62,500 and measures 37 by 53 inches.

The skillful and interpretative relief shading strikingly presents the major topographic characteristics of this rugged and elongated island park. The map is also available in a contour edition. Orders for either map can be sent to U.S. Geological Survey, Washington 25, D.C.

An *Official Map of Louisiana* was published in 1959 by that State's Department of Public Works. The map, which is at the scale of six miles to an inch, shows State and parish boundaries, cities and towns, marsh and swamp lands, State parks and forests, levees, roads, airports, military bases, and other physical and cultural features. Cartography is by Leonard R. Kirst and Robert E. Simons. Measurements are 55 by 59 inches. Lithography is by A. Hoen & Co. of Baltimore.

The *Central Valley of California* is portrayed, at the scale of 1:250,000, on a three-sheet topographic map published by the U.S. Geological Survey in 1958. Each sheet measures 37 by 45 inches. Relief is shown by contours.

The Oregon State Highway Department, in cooperation with the U.S. Bureau of Public Roads, published in 1958 a *Rural Traffic Flow Map, State of Oregon*. It is at the scale of 1:2,000,000 and measures 10¼ by 13½ inches. Primary and secondary volumes of traffic are shown by colored lines of varying width. Enlarged inset maps on the verso show the flow of traffic into various urban centers.

Water Powers of Canada is a publication of the Water Resources Branch, Canadian Department of Northern Affairs and National Resources. It outlines major geological regions in addition to showing developed and undeveloped waterpower sites. This blue-line print map is at the scale of 1:6,250,000 and measures 20 by 33 inches.

Colorprint Mapa General de Cuba presents that island in gradient-tint relief. The map was compiled and edited by P. Fernandez y Cia., Calle Hospital No. 619, Havana, Cuba, and was printed by American Map Co., Inc., of New York City. In addition to relief this large (41 by 61 inches, 1:750,000) map shows several classes of cities, administrative boundaries, roads, railroads, coastal and ocean shipping lanes, aids to navigation, and airports.

General Map of the Republic of Egypt presents the administrative divisions, transportation systems, cities and towns, and tourist attractions of the new republic on the Nile. The publisher

is Cairo Drafting Company. Lower Egypt is presented at the scale of 1:500,000 and Upper Egypt is at 1:1,000,000. Printed on the map sheet is a comprehensive and useful index of towns.

Six sheets, comprising Series 1: Galilee, of the new *Geological Map of Israel* have recently been received. This series, at the scale of 1:50,000, was prepared by A. Vroman. Publisher of the map is the Geological Survey of Israel, in the Ministry of Development. Names and sheet titles on the maps are in Israeli and English, but the legends are given only in Israeli.

Malaya 1958, is a two-sheet, physical-administrative map, at the scale of 1:500,000. It was compiled by the Survey Department, Federation of Malaya, and published under the direction of the Surveyor General. Relief is indicated by hypsometric tints and contours. Administrative boundaries, roads, railroads, and inhabited places are among the cultural data shown. An inset shows the relationship of Malaya to adjacent land and water regions.

Queensland Showing Areas Under Forestry Control delimits State forests, timber reserves, and national parks in Australia's northeastern province. General relief (by color gradients) and rainfall distribution, (by isohyets) are also mapped. The map is a publication of the Queensland Forestry Department, with cartography by J. A. Craig. The scale is 1:3,200,000 and the size is 42 by 33 inches.

The Moon (Projected Relief Model of Visible Side) is a three-dimensional map of our lunar satellite. The surface of the moon is presented as a segment of a sphere and portrays the crater-pitted land masses in white and the water areas in blue. The map is in light-weight flexible vinyl plastic. The scale (1″ to 140 miles) and a list of "Lunar Facts" are printed at the bottom of the plastic sheet. The moon model is manufactured by Space Craft, Inc., P.O. Box 576, Harbor City, California.

WALTER W. RISTOW

Library of Congress

One Part in Five Million

A release dated September 21, 1959, states that for the first time in its history the National Bureau of Standards has certified the accuracy of its length measurements made on two commercial gage blocks to better than one part in five million.

Gage blocks, carefully made blocks of steel, are used to monitor manufacturing processes in the mass production of interchangeable machined parts. An ultraprecise application of gage blocks is involved in the production of critical components for space vehicles and systems. The further man goes in probing outer space, the more important become the critical tolerances of precision components. For example, according to one prominent manufacturer, an error of one-millionth of an inch in the bore-hole of a gyro can result in a complete miss during a moon shot. Measuring that millionth of an inch can be compared to an attempt to detect one quarter dollar in a stack of quarters three times as high as the Empire State Building.

The measurements announced September 21, 1959, and described at the 14th Annual Instrument-Automation Conference and Exhibit of the Instrument Society of America in Chicago, September 21–25, were made on a 16-inch and an 18-inch gage block, both sent to the Bureau by the Moore Special Tool Company. Each gage block was converted into a line standard by wringing a graduated gage block to each end. They were then compared with the working standards of the United States —bars with carefully engraved lines marking the standard distances. This part of the calibration was performed by Benjamin L. Page of the NBS length laboratory.

The blocks were then measured in terms of wavelengths of light by Arthur G. Strang of the Bureau's engineering metrology laboratory. The results obtained by the two methods agreed to the nearest millionth of an inch or better for both gage blocks. This not only "proves" the accuracy which can be obtained in gage-block measurements, but it also serves to verify the accuracy of the wavelengths of various light waves as expressed in terms of the international meter bar. The NBS measurements also agreed to two microinches with independent measurements made by the National Physical Laboratory (England) on the same blocks.

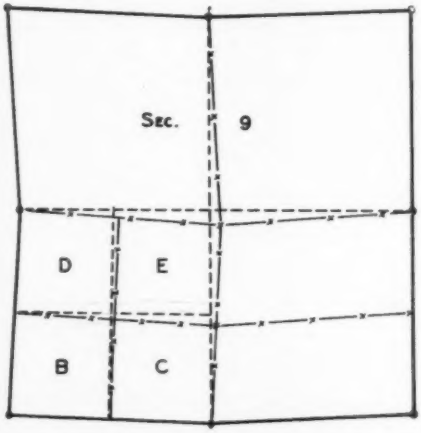
Improved accuracy of NBS calibrations in this field is the aim of a special research project sponsored jointly by the Bureau and a group of leading manufacturers and users of gage blocks. The goal of this program is to provide the basis for a regular NBS gage-block calibration service with certified accuracies of one part in ten million or better. The present routine accuracy of gage-block calibration is two parts in a million.

The Surveyor and the Law

Fence Lines and Written Title Lines

From Robert D. Hall (Civil Engineering and Land Surveying), 151 E. Hoffman Road, Green Bay, Wisconsin, I received the following hypothetical question:

"Because more than just a few surveyors I have talked with are willing to accept the fence lines as the subdivisional lines prescribed by the U. S. Government, I want to ask for your opinion. Enclosed is a sketch (see accompanying sketch) showing what I might find when I



survey for 'D' who wants to sell off the south 15 acres of his farm. Please tell me what to do and what to advise Mr. 'D' to do to accomplish the sale of his 15 acres. The facts are: Original U. S. Government survey of section 9 was in 1841. The SW¼ was patented to 'A' in 1868. In 1869 'A' caused the land to be surveyed into quarters and later fences were erected in accordance with the survey. 'B' acquired deed to the SW¼ of the SW¼ in 1880. 'C' acquired SE¼ of the SW¼ in 1896. 'D' acquired the NW¼ of the SW¼ in 1904. 'E' acquired the NE¼ of the SW¼ in 1908."

Answer: This question involves three separate and distinct issues: (1) Original survey lines as laid out by the original government surveyor, (2) an improper division of a section some time after the original survey, and (3) the legal acquisition of property by unwritten means. The answer to the problem, in my opinion, is summarized by the following:

Principle: *"The boundaries of the public lands, when approved and accepted are unchangeable, except by resubdivision."* (Restoration of Lost Corners, page 6.)

The first conclusion is that the exterior boundaries of this section must legally be relocated exactly where they were in 1841. It is presumed that the sketch correctly shows these corners and lines as they were originally laid down by the original surveyor.

The words "original survey" need some explanation. Original surveys are made to measure quantities of land prior to conveyancing and have these three characteristics: (1) Monuments are set prior to conveyancing, (2) the survey (which automatically includes monuments set) is called for by the conveyance, and (3) the lines as run by the original surveyor are considered as correct whether in their measured position or not. A resurvey is for the purpose of relocating original survey lines and should never be confused with an original survey.

The original government surveyor seldom ran other than the exterior lines of a section. If the interior lines were run and if the interior survey were called for by the conveyance (patent), these lines as run would be correct where run. But I assume that in this section these interior lines were not run by the government surveyor (this can be checked by reading the original notes). Where the interior lines were not run, the Federal statutes specify the method by which sections shall be divided. This is a Federal law, not a State law. This law is applicable to subdivision of sections for (1) the exterior lines of all patents issued by the Federal government and (2) all subdivisions of sections made while the State was a Territory. After Wisconsin became a State, any further division into parcels (or portions of sections) came under State laws. Common law specifies that when a person sells half of his land he sells half of his area. Federal statute says that half of a section is determined by connecting opposite quarter corners; hence, half in the case of

Federal law does not mean equal area. Most States make an exception to the common law and recognize the Federal statute (connecting opposite corners) as being applicable in the case of sectionalized lands. There are minor exceptions to this. In Wisconsin the law, according to Section 59.62 of the 1951 statutes, is: "When a surveyor is required to subdivide a section or smaller subdivision of land established by the United States Survey, he shall proceed according to the Statutes of the United States and the rules and regulations of the Secretary of the Interior in conformity thereto." Since this is so, then *these lines are unalterable except by resubdivision.*

Principle: *Land lawfully gained by unwritten means extinguishes the old written title, but it does not alter the position of the original survey lines.*

Original survey lines are unalterable, but titles do not have to follow them. Just because there are survey lines does not mean that the survey lines and title lines are coincident. By certain acts of possession, land can be gained or lost by unwritten means. You have indicated that the fences are of exceedingly long standing and that title has probably passed by unwritten means. Let us assume that it has. Owner "D" then has a title, though not necessarily a written title, to all of the land he has enclosed within his fences. He has lost title to land not enclosed. His title "NW¼ of the SW¼" does not correctly describe his ownership. Paper title and ownership may be identical, but they do not have to be, and in this case they are not.

The south 15 acres of the NW¼ of the SW¼ does not describe the south 15 acres of "D's" ownership. The only way for "D" to clearly convey the south 15 acres of his ownership is by writing a metes and bounds description.

Instances of where possession is out of agreement with paper title lines and where possession has ripened into a fee title are difficult for the surveyor. The surveyor is not qualified, nor is he authorized, to state when possession has changed from an encroachment to a fee title. This is a judicial matter for the courts and the attorneys.

The surveyor is an expert qualified to discover and state what the facts are. He does not try to solve the owner's problem of possession. There is nothing in most laws that prohibits the surveyor from recognizing fences as ownership lines; he does not do so merely because of liability and ethics. When an owner asks a surveyor to survey out the NW¼ of the SW¼, he wants to know where his paper title lines are. After all, he knows where his fences are; he wants to know whether the fences and the paper title are in agreement. If the surveyor certifies that the fences and the paper title are coincident, and they are not, he is assuming the burden of proof. If owner "D" loses part of his land because of paper title difficulties, he then sues the surveyor.

The surveyor is hired to show the facts as they exist. If he fails to do so and damage results from his failure, he may be liable. Of course, the surveyor in this case will cause some discomfort to "D," but not all surveys are favorable to the client. Owner "D" must solve his own problem. The surveyor can only point out what the problem is. There are many actions at law whereby paper title and possession ownership can be made to coincide. If a title company had knowledge of "D's" situation, they would not insure paper title within the fenced area. Why should they buy a law suit? Prospective owners would probably be reluctant to buy the south 15 acres of "D's" ownership, since they may be buying litigation.

Some surveyors in cases of this type do set markers in the fence corners. This reasoning is often based upon the fact that if people have lived peaceably next to one another for twenty years or more without disturbance, why should trouble be stirred up? This is short sighted.

My opinion is that the owner has hired the surveyor to point out the facts. The surveyor is obligated to discover the correct facts and call them to his client's attention. If his fences encroach on another's paper title lines, such facts should be noted. However, the client should also be told he can lose or gain land by possession and other unwritten means. It should be further pointed out that his fence lines might be ownership lines and that he should see an attorney.

The surveyor should never be a part of a fraud. If he is to describe the south 15 acres of "D's" ownership, he should never do anything that will induce a prospective buyer into thinking that paper title lines and ownership lines are the same. If a surveyor knows that paper title lines and fences are not coincident and he issues a plat showing them to be, he is setting up the conditions for fraud. All the seller has to do is to show the plat and the buyer will jump to a logical erroneous conclusion.

You have noted that in 1869 a survey was made to divide the SW¼ and fences were erected on these lines. This survey was not an original survey of the government and it merely

purported to locate each quarter of the SW¼. Since the surveyor erred, it can be corrected. Age does not make an incorrect survey correct. However, it is apparent that possession has followed these lines and possession has probably ripened into a fee title (unwritten). Such conditions do not give the surveyor the right to hide the true facts from his client, and fail to give him notice that his possession and paper title lines are out of phase.

Fences, at times, are ruled to be monuments as to where the original surveyor ran his original lines. Thus, if an original surveyor surveyed along certain lines, and fences were soon afterward erected along these lines, the fences might be declared as monuments representing where the original surveyor ran his lines. But in this case the original surveyor did not run interior lines, hence the fences cannot possibly be monuments representing where the original surveyor ran his lines. The later surveyor (1869) was not an original surveyor. Any line can be given force by possession, and the courts might rule that the 1869 survey lines are ownership lines, but they should never be given the status of correct sectional subdivision lines.

The Technical Standards for Property Surveys as adopted by the American Congress on Surveying and Mapping state, "Every parcel of land whose boundaries are surveyed by a licensed surveyor should be made conformable with the record title boundaries of such land." So be it.

—CURTIS M. BROWN

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Earl G. Harrington Retires

Announcement has been made of the retirement of Earl G. Harrington, Cadastral Engineering Staff Officer in the Bureau of Land Management, U. S. Department of the Interior, Washington, D. C., on September 30, 1959, after more than 51 years of active service.

Mr. Harrington entered the service of the former General Land Office in a temporary capacity as a subordinate assistant on one of the survey parties in Oklahoma in May 1908. Through demonstrated and outsanding ability, Mr. Harrington advanced successively through the ranks from the most subordinate position in the survey party to the highest position in the cadastral surveying organization of the Bureau of Land Management. During the early years of his service, Mr. Harrington's work was almost entirely on Indian Reservations, in defining the boundaries of lands for allotment purposes and general tribal administration. His exceptional technical and administrative ability was recognized early in his career, and his field assignments were progressively of a more complicated and difficult nature.

After 20 years of making surveys in the field, Mr. Harrington was brought into the headquarters office in Washington in order that his abilities might be employed on the broader aspects of the cadastral survey work of the General Land Office. With the creation of the Bureau of Land Management in 1946, he was designated Acting Assistant Chief of Engineering of the Bureau. On January 1, 1949, he was appointed Chief of the Division of Cadastral Engineering, the title of which position was later changed to Cadastral Engineering Staff Officer.

His long experience and outstanding qualifications led to his selection by the States of Wisconsin and Michigan to conduct the resurvey of the boundaries of those State pursuant to decision of the Supreme Court of the United States. He is recognized as an authority in the field of Cadastral Engineering and as such was designated as the representative of the United States to a conference of British Commonwealth and United States survey authorities in Wellington, New Zealand, in 1950. He was also a delegate to the Conference on World Tenure Problems at Madison, Wisconsin, in 1951. He has taken a leading part in the solution of problems incident to defining the rights of the Federal Government in the area of the outer Continental Shelf where tremendous mineral resources are being developed.

Mr. Harrington is expected to maintain his home in Washington, D. C., but will have leisure time for traveling.

DONALD B. CLEMENT

Books in Review

PHOTOGRAMMETRY. Francis H. Moffitt. *International Textbook Company,* 1959. 455 pp. $12.00

This recent addition to the rapidly expanding field of literature on the subject of photogrammetry fulfills a long-felt need for a comprehensive treatment of the basic principles of photogrammetry without becoming too involved with the details of any one of the several specialties of the subject.

The selection of material is excellent and the author is to be commended for eliminating extraneous material. The subject matter is presented in a logical sequence and is supported with a number of excellent figures for a ready understanding of the basic geometry of photogrammetry. The author's approach is especially useful to the surveyor who does not have available to him the more expensive plotting equipment but wishes to take advantage of aerial photography. Considerable material is devoted to terrestrial photogrammetry.

The Multiplex, Kelsh, Balplex, Wild, and Zeiss instruments, in fairly common use in this country, are discussed with emphasis on the less expensive instruments. Stereotemplet construction is explained in addition to several other instrument techniques available to users of the less complicated equipment.

This book will serve the dual purpose of an introductory text on photogrammetry and a reference for the engineer, surveyor, or cartographer whose interest in photogrammetry is general rather than specialized.

C. E. COOK

MAPS OF THE UNITED STATES. W. R. Tobler, $5\frac{1}{2} \times 8\frac{1}{2}$, lithographed, illus., 32 pp. $1.25.

This paper covered booklet is "a guide to what maps are available, where obtainable, and how to order." It covers in considerable detail the offerings of the U. S. Geological Survey and Coast and Geodetic Survey. Less space is devoted to maps of other Federal agencies and State agencies, as well as to maps produced by county and city agencies. A section gives some information concerning commercial map publishers in the United States. This is followed by "a few tips" on how to go about finding maps that are needed in any specific instance, and the last page is devoted to a short bibliography or list of "useful references."

The price of this booklet (nearly four cents a page) seems to be rather high, even in these days of high printing costs, but, for those who are in need of this type of information in capsule form, the booklet could be well worth the price as a timesaver when searching for particular types of maps.

Apparently the compiler of this booklet became a member of the ACSM in 1957 while a graduate student at the University of Washington. The booklet is obtainable from W. R. Tobler, 21609 78th Place W., Edmonds, Washington.

HOWARD S. RAPPLEYE

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Abstracts of Articles on Geodesy and Related Fields

The Army Map Service, of the Corps of Engineers, U. S. Army, publishes quarterly a series of processed sheets under the title: "Abstracts of Articles on Geodesy and Related Fields." The following are excerpts from the issue bearing the date of July 1959 and are selected for reprinting in SURVEYING AND MAPPING as being of possible interest to a considerable percentage of our readers. The selection has been somewhat arbitrary, and only those abstracts believed to be of quite general interest have been included. —EDITOR

533 *The Reduction of Electronically Measured Distances to the Geodetic Reference Surface* (Zur Reduktion elektronisch gemessener Strecken in die geodaetische Bezugsflaeche). Borivoj Delong

The results of electronic distance measurements are not immediately usable for geodetic purposes since they are encumbered by quite a few systematic errors of physical origin and do not represent the exact length of the geodesic. The elimination of the physical errors, such as changeable atmospheric conditions and the imperfection of the instruments is called the physical reduction. The mathematical reduction has the object of transforming distances to which the physical reduction has been applied into geodesics.

For the purposes of this study which considers only the mathematical reduction the distances are divided into two categories:

I—distances up to 50 km.

II—distances of 100 to 600 km. (or longer). The reduction for both categories will be made to an accuracy on the order of 1 cm.

From the physical reduction, we obtain the length of the arc which connects the two end points of the distance measured and is located in a plane defined by the normal to the ellipsoid at the initial point and by the end point. The mathematical reduction therefore has the task of transforming the distance D (measured in space) of the arc with the radius kR to the length of the geodesic s which is located on the reference ellipsoid. Here, R denotes the mean radius of the earth and k the coefficient of the electro-magnetic refraction. The solution of this task is divided into four phases:

1. Transformation of the distance D and the physical reduction into the reference sphere with the radius N_1 for the latitude ϕ_1 of the initial point A which will give the length of the arc s'.

2. Transformation of the arc s' on the sphere with the radius N_1 into the elliptical arc $\bar{s}$ of the reference ellipsoid. Both arcs are located in the same normal plane as the original distance D.

3. Transformation of the elliptical arc $\bar{s}$ into the elliptical arc s_0 which also is a normal section and connects the base points A_0 and B_0 of the normal at the points A and B.

4. Transformation of the elliptical arc s_0 into the geodesic s which is the shortest connection of the base points of the two normals and simultaneously the result of the reduction.

The author then develops the formulae for all four phases of the computation and gives a sample computation for a distance in category I. The same computation procedure can be used for distances in category II, but if an accuracy on the order of 1 cm. is desired all numerical data must be increased by three powers.

STUDIA GEOPHYSICA ET GEODAETICA (German) AMS-GL-B662.7400, Vol. 2, No. 1 (1958)-ms

534 *Recovering a Lost Trignometric Point* (Vyhledáni ztraceného trigonometrického bodu). Zdeněk Šimon

It is suggested that a lost trigonometric point be recovered by resection and the method of approximation.

Three known points (P_1, P_2, P_3) are used in order to recover the lost point (P_4). At the lost point angles ω_1', and ω_2' are measured, while angle ω is known. Therefore, $d\omega_1 = \omega_1' - \omega_1$, and $d\omega_2 = \omega_2' - \omega_2$. The side s, and the angle $(\phi + \psi)$ can be approximately determined or measured from the map.

By further derivations the mean square error of the point P_4 is obtained as follows:

$$M^2 = -\frac{S^2 24}{\sin^2(\varphi - \psi)}\left[\frac{S^2 14}{S^2 12} + \frac{S^2 34}{S^2 23}\right] m^2{}_w$$

GEODETICKÝ A KARTOGRAFICKÝ OBZOR (Czech) AMS-GL-B662.7200 Vol. 4/46, No. 7 (1958)-ma

535 *The Theory of Computational Aerial Triangulation* (Teorie početní aerotriangulace). Karel Tomsa

The theory of computational aerial triangulation had been developed on the basis of kinematic theorems.

The correlative relationship between the survey and the terrain features are established in the following manner: the pencil of rays given by the image and the internal orientation of the camera are brought, by proper movements, into a similar position to that the pencil had assumed at the moment of exposure. The position of the pencil is expressed by means of components in the directions of the axes of the coordinate system of the movable space, thus eliminating the six conditions of the orthogonality of the axes. The equations are solved in a linear differential form. The results appear as corrections to the selected initial position of the pencil.

In order to take into consideration special conformal projection conditions, the pencil can be compressed under certain conditions by curves defined in a random manner and then shifted and rotated similarly to the rectilinear one. The final discrepancies in the aerial triangulation are to be distributed either linearly over the occupied points or by taking into consideration the establishment of points to be covered by the triangulation.

The selection of the computation procedure depends on the value and distribution of the ground control points, the photogrammetric instrument, and the computing installation. The photos can be measured by a comparator with one or several plates or by a radial triangulator.

The equations presented are suitable for any type of terrain.

GEODETICKÝ A KARTOGRAFICKÝ OBZOR (Czech) AMS-GL-B662.7200. Vol. 4/46, No. 11 (1958)-ma

536 *Conformal Transformation from One Ellipsoid onto Another* (Konforme Transformation von einem Ellipsoid auf ein anderes Ellipsoid). Miloš Pick

The problem of conformal transformation of a trigonometric net from one ellipsoid onto another is solved in the following manner:

The reference point $K_0{}^1$ (φ_0, λ_0), the position of which is determined by the geodetic coordinates of the first ellipsoid, is represented at the point $K_0{}^2$ (B_0, L_0);

The azimuth of the base-line a_0 of the first ellipsoid is transformed into the azimuth $A_0 = a_0 + \Delta A_0$;

Simultaneously, at the point K_0, the change of the net scale takes place in reference to τ_0, where τ_0 represents the change of scale at a changeable point with retained orientation.

The derived equations meet the requirements for the accuracy of a trigonometric net. The maximum distance between the terminal and the initial point—for the mean latitude ($\varphi_0 = 50°$)—is 1,000 km., under the conditions that, (1) the maximum value of the change in the latitude is ($|B_0 - \varphi_0|$) max. = 20″, and (2) that the maximum value of the change in azimuth is ΔA_0 max. = 20″.

Practical examples for the conformal transformation for each problem are given.

STUDIA GEOPHYSICA ET GEODAETICA (German) AMS-GL-B662.7400, Vol. 1, No. 1 (1957)-ma/ms

540 *Some Comments on the Observation of Horizontal Angles* (Einige Bemerkungen zur Horizontalwinkelmessung). Leopold Kolb

The experience is confirmed that groups of sets observed on different days, but at the same hour each day and in good observing weather, need not show good agreement. The differences between the individual groups may amount to a multiple of the mean errors of direction. This phenomenon has to be ascribed to the change in refraction which remained constant only during the short period of observation.

It is shown that the pointing error increases nearly linearly with respect to the dimensions of the lights during observations in the first order net. It is also shown that, when using modern triangulation theodolites, observation in double or quadruple sets diminishes the pointing error and makes it possible to obtain a smaller mean error and in a shorter time than with the method used to-date.

A report is given on experiences made during observations with a five-hair-reticule mounted in a Wild T 3 theodolite. The distances between the five hairs are not absolutely equal. The mean distance of the hairs, expressed in angle measurement, depends also on the focal

length of the objective lens and therefore amounts to only about 200^{cc}. However, these irregularities do not affect the observation itself.

The distance of the hairs also depends on the vertical angle h and increases with sec h. Up to about $h = 8^g$, the increase in the distance of the hairs remains below the mean pointing error and the change in the distance of the hairs is felt only in the high mountains for steep lines of sight. Consequently, the increase in the distance of the hairs has to be taken into consideration when computing the mean pointing error for steep lines of sight.

DEUTSCHE GEODAETISCHE KOMMISSION BEI DER BAYERISCHEN AKADEMIE DER WISSENSCHAFTEN Publications Series B: Applied Geodesy (German) AMS-GL-B664.2250 No. 49 (1958) ms

541 *Practical Studies on the Use of the Least Squares Method in Photogrammetry* (Praktische Untersuchungen ueber die Verwendung der Methode der Kleinsten Quadrate in der Photogrammetrie). B. Hallert

The use of the grid method and the method of vertical parallaxes are explained in detail.

For the use of the grid method two fundamental differential formulae are written as correction equations [(3) and (4)] for the grid square having the format $2a$ by $2a$. It is shown how to use the two equations for an adjustment of the coordinate discrepancies in five points of a projected grid. As direct functions of the coordinate discrepancies, the corrections to the elements of the exterior orientation are given in another two equations. Special expressions are presented for the coefficients of weight of the corrections as well as for the computation of the mean error in the unit of weight.

If coordinates had been determined for more than the five points used in the adjustment, the residual corrections v_x and v_y for each point, and the corrections to the elements of the exterior orientation could be computed by means of the above mentioned formulae. It is assumed that the existing errors are mainly accidental in character, the mean errors of the corrections v_x and v_y are computed by means of the general law of the propagation of errors. The mean error in the unit of weight must be given at the scale of the grid plane.

If an adjustment is made with five points according to the grid method and then the corrections of other points measured simultaneously according to (3) and (4), the mean square error of the residual x and y errors for such points should be 1.17μ within the square of the control points; where μ is the mean error in the unit of weight of the coordinate measurements according to the adjustment. However, the mean error in the unit of weight is not free of errors. The mean error for the mean error in the unit of weight can be computed in every case, thus it can be seen whether the discrepancies between theoretical and practical values are statistically normal or not, i.e., whether the theoretical accuracy of an adjustment according to the least squares method agrees with reality or not.

From the measured vertical parallaxes corrections to the preliminary data for the elements of reciprocal orientation are computed. If the parallaxes have been measured in more than five points, an adjustment can be made. Corrections to the simultaneously measured vertical parallaxes at random points can be computed after the adjustment. The measurement of parallaxes should be carried out at least at 9 and, for best results, at 15 points. The corrections to the measured vertical parallaxes are computed only by means of the adjustment for six points. The mean square value of the residual parallaxes at all points not used in the adjustment should be about 1.22μ. It is assumed in principle, however, that mainly accidental errors occur.

An example is given to support the abovementioned suggestions on the use of the least squares method in photogrammetry.

ZEITSCHRIFT FUER VERMESSUNGSWESEN (German) AMS-GL-B664.7001, Vol. 84, No. 1 (1959)-ms/ma

542 *New Aids in Numerical Photogrammetry* (Neue Hilfsmittel der Numerischen Photogrammetrie). K. Schwidefsky

Topographic photogrammetry, in the last decades, has developed so pronouncedly along graphic lines that it was often thought of fundamentally as a graphic method. Modern developments, however, have shown that numerical photogrammetry is also possible and necessary. Since the use of mathematical-numerical methods is characteristic of the general tendencies of development in present-day technology, economics, and administration, the new instruments created for these fields are also available to photogrammetry. Here, we first have new conceptions such as were established for data processing and the theory of information. The new methods based on these conceptions are already

proving their worth in photogrammetry; great developments can be expected in the next few years. This will exercise a strong influence on the construction of photogrammetric instruments. New instruments are needed. The author concludes his paper with a description of a new recording device for use with the stereoplanigraph and a new stereocomparator, both made in Germany.

DEUTSCHE GEODAETISCHE KOMMISSION BEI DER BAYERISCHEN AKADEMIE DER WISSENSCHAFTEN, Publications Series A: No. 28/III (German) AMS-GL-B664.2200 No. 28/III (1958)-ms

546 *Experimental Test of the Trigonometric Leveling on the Ellipsoid* (Saggio sperimentale della livellazione trigonometrica ellissoidica). Prof. Bartolomeo Bonifacino

The main difficulty in trigonometric leveling is the fact that observations refer to the vertical but computations are carried out on the reference ellipsoid.

In order to test the effect of the geometric scheme a large amount of observation data obtained during the computation of the National triangulation has been analyzed. The following definite results have been obtained:

$$x = (0.315 \pm 0.091) \text{ m.} \qquad (21)$$

$$y = (0.015 \pm 0.003) \text{ m.} \qquad (22)$$

where x represents errors independent of the distance, and y errors dependent on the distance.

From (21), one can see that the magnitude of errors independent of the distance is of an order comparable to the uncertainty usually encountered in such a type of operation. And (22) shows that the dependent errors (i.e., errors due to the zenithal distance observations, uncertainty of refraction, effects of the deflection of the vertical, etc.) are in equilibrium with the approximation which can be generally expected in trigonometric leveling.

RIVISTA DEL CATASTO E DEI SERVIZI TECNICI ERARIALI (Italian) AMS-HD671 R62, Vol. 13, No. 5 (1958)-ma

548 *Oblique Cartographic Networks* (Siatki kartograficzne ukośne). F. Biernacki and J. Panasiuk

Computation of cartographic networks in oblique projections is a very difficult operation. Therefore, it is recommended to make the scheme of the form of the network first, and then to carry out the computation and the construction of the network.

A procedure is suggested for examining the form of an oblique cartographic network for all projections from spherical surfaces onto a plane, based on the parameters φ_0, λ_0, a_0 of an isometric transformation of geographic coordinates φ, λ into azimuthal spherical coordinates z, a.

GEODEZJA I KARTOGRAFIA (Polish) AMS-CL-B676.7300, Vol. 7, No. 2 (1958)-ma

549 *Transformation of Rectangular Gauss-Krüger Coordinates to the Adjoining Zone* (Przeliczanie współrzednych prostokatnych Gaussa-Krügera na układ sasiedni). Jerzy Zieliński

The problem of the transformation of the increase in coordinates of a given zone ($\Delta x = x - y_0$, $\Delta y = y - y_0$) into the increase in coordinates of the adjoining zone ($\Delta x' = x' - x_0$, $\Delta y' = y' - y'_0$) has to be solved: where x_0 represents the abscissa of the point located at an equal distance from the meridian axis of both zones, $y_0 = (c) \cdot 1{,}000{,}000 + 5{,}000{,}000 + (y)$, (c) represents the number of zones.

For the computation of $\Delta x'$ and $\Delta y'$ the following formulae are used:

$$\Delta x' = a_2 \Delta x - a_1 \Delta y + a_4 \, (\Delta x^2 - \Delta y^2) - a_3 2 \Delta x \Delta y$$

$$\Delta y' = a_1 \Delta x + a_2 \Delta y + a_3 \, (\Delta x^2 - \Delta y^2) + a_4 2 \Delta x \Delta y$$

On the basis of the theories outlined in the "Handbuch der Vermessungskunde" by W. Jordan, special tables were computed for the transformation of $\Delta x'$ and $\Delta y'$ in 3° and 6° zones of both the Bessel and Krasovskiy ellipsoid, using the argument $\Delta x \leq 30$ km., and $\Delta y \leq \pm 50$ km. The accuracy obtained for $\Delta x'$ and $\Delta y'$ is 0.01 m.

The formulae for the transformation are also presented in the Cracovian form.

PRZEGLAD GEODEZYJNY (Polish) AMS-GL-B676.7100, Vol. 13, No. 11 (1957)-ma

551 *New Methods of Studying the Figure of the Earth* (Novye metody izucheniya figury Zemli). M. S. Molodenskiy

Since the density of the earth's masses is insufficiently known, the traditional solution of reductions to the surface of the geoid are not characteristic for the geoid but for another surface, the so-called quasigeoid. The desired high accuracy can be obtained by new methods which have no reductions. Therefore, measurements of vertical angles are replaced by geometrical and astronomical levelings.

The distance H of a selected point on the

earth's surface from the reference ellipsoid is determined by

$$dH = dh - (\xi \cos A - \eta \sin A)\, dl$$

where

dH = the total differential of H at displacement of the point on the earth's surface along the azimuth A at a distance, the horizontal extension of which is equal to dl;

dh = initial difference in elevations determined by a level;

ξ and η = components of the angle formed by the vertical and the normal to the reference ellipsoid.

The problem of triangulation is solved in principle by the application of this formula.

GEODEZIYA I KARTOGRAFIYA (Russian) AMS-GL-B675.2214, No. 11 (1957)-ma

553 *Determination of the Velocity of Light* (Opredelenie skorosti sveta). V. A. Velichko

Two Soviet designed light-distance-meters (SVV-1 of 1956 and its improved version SVV-1 of 1957)* were used in the determination of the velocity of light carried out during the period 1956–1957 at the following baselines: Dugninsk, Krivoi Rog, and Novostarodubsk.

A detailed description of the operations carried out at each of these base-lines is presented.

It is reported that measurements carried out by the light-distance-meters do not show systematic errors.

The velocity of light (s) is reported to be

$$s = 299{,}792.7 \pm 0.3 \text{ km./sec.}$$

GEODEZIYA I KARTOGRAFIYA (Russian) AMS-GL-B675.2214, No. 10 (1958)-ma

561 *Systematic Influence of the Leveling Refraction* (Sistematski uticaj nivelmanske refrakcije). Jovan Stevanović

After a brief description of Lallemand's, Hugershov's and Kukkamäki's formulae for the correction for the refraction H in leveling, the Kukkamäki formula is selected as the best one:

$$H = \text{ctg}^2\gamma \cdot d \cdot \frac{v}{z^c{}_2 - z^c{}_1} \left[\frac{1}{c+1}(h_1{}^{c+1} - h_2{}^{c+1}) - h_o{}^c (h_1 - h_2)\right]$$

where: $\text{ctg}\ \gamma = \frac{L}{\Delta h}$; L = the distance between the fore-rod and the back rod; Δh = the difference in elevation between these rods;

$t = a - bz^c$; $d = -10^{-6}$

$$[0.933 - 0.0064\,(t-20)] \cdot \frac{B}{760}\,;\ t_1 =$$

the temperature at the z_1 elevation; t_2 = the air temperature at the z_2 elevation; B = barometric pressure; h_1 = reading at the first rod; h_2 = reading at the second rod; h_o = the height of the instrument; a, b, c = constants when the temperature t is measured at three different elevations; $v = t_2 - t_1$ = the difference in air temperature at the elevations z_1 and z_2.

When $v = 0°.3$; $c = -0.2$; $z_1 = 30$ cm.; $z_2 = 120$ cm.; $B = 760$ mm.; $t_{\text{mean}} = 15°$; $h_1 = 20$ cm.; $h_0 = 150$ cm.; $h_2 = 280$ cm. the Kukkamäki formula is applied and we have $H = 10^{-6} \cdot 10.6 \cdot \text{ctg}^2\gamma$.

Instead of determining H at each station it is possible to determine an overall correction H_s between the benchmarks by using the formula

$$\text{ctg}\ \gamma = \frac{S_m}{\Sigma \Delta h_m}$$

where: S_m = distance in meters between two benchmarks; $\Sigma \Delta h_m$ = the total elevation difference in meters between the two bench marks.

$$H_s = \frac{S^2 k_m}{\Sigma \Delta h_m}$$

Special diagrams are presented for such computations.

As an illustration, computations of the correction H_s carried out for 22 loops of the Yugoslav leveling net are presented.

GEODETSKI LIST (Serbian) AMS-GL-B658.-7100, Vol. 11, No. 3/4 (1957)-ma

* For a detailed description of the instrument see the "Geodetic Abstracts" Vol. 3, no. 2 (1958), pages 36–38.—EDITOR

Releveling Through Hebgen Dam Area

The Coast and Geodetic Survey line of levels from West Yellowstone to Sappington, Montana, has been rerun since the earthquake of August 17, 1959, and the results show a quite remarkable settlement of several of the bench marks.

The original line was run in 1934 and the new leveling shows a maximum difference of – 18.86 feet about four miles southeast of the Hebgen Dam. This is believed to be the greatest vertical displacement resulting from an earthquake which has been detected by precise leveling in the western part of the United States.

Map Information

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.

—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published or became available for distribution by the U. S. Geological Survey between June 1 and August 31, 1959. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or without the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown—except those marked with the letter (P), which are planimetric); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, township and section lines are shown. The State rectangular coordinate and the UTM 1,000-meter grid systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C., (or Denver 15, Colorado, for maps of areas west of the Mississippi River).

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* Indicates 15-minute quadrangles; all others are 7½-minute quadrangles.
[1] Indicates a revised map.
[2] Indicates a series-converted map.
† Indicates availability in either a contour or a shaded-relief edition.
‡ Indicates preliminary black and white edition.

Alabama
ATHENS—Limestone
FORT MORGAN NW—Mobile

Alabama-Tennessee
ARDMORE—Madison
ELKMONT—Limestone
TONEY—Madison

Alaska
BAIRD MOUNTAINS A-1*
BAIRD MOUNTAINS A-2*
BLACK RIVER A-2*
BLACK RIVER A-3*
BLACK RIVER A-4*
BLACK RIVER A-5*
BLACK RIVER A-6*
BLACK RIVER B-1*
BLACK RIVER B-2*
BLACK RIVER B-3*
BLACK RIVER B-4*
BLACK RIVER B-5*
BLACK RIVER B-6*
BLACK RIVER C-1*
BLACK RIVER C-2*
BLACK RIVER C-3*
BLACK RIVER C-4*
BLACK RIVER C-5*
BLACK RIVER C-6*
BLACK RIVER D-3*
BLACK RIVER D-4*
BLACK RIVER D-5*
BLACK RIVER D-6*
BRADFIELD CANAL A-6*
BRADFIELD CANAL B 6*
CIRCLE A-3*
CIRCLE B-1*
CIRCLE B-2*
CIRCLE B-3*
CIRCLE C-1*
CIRCLE D-2*
KETCHIKAN A-1*
KETCHIKAN A-4*
KETCHIKAN A-5*
KWIGUK A-1*

KWIGUK A-2*
KWIGUK A-3*
KWIGUK A-4*
KWIGUK A-5*
KWIGUK A-6*
KWIGUK B-1*
KWIGUK B-4*
KWIGUK B-5*
KWIGUK B-6*
KWIGUK C-5*
KWIGUK C-6*
KWIGUK D-4*
KWIGUK D-5*
KWIGUK D-6*
LIVENGOOD B-5*
LIVENGOOD B-6*
LIVENGOOD C-5*
LIVENGOOD C-6*
LIVENGOOD D-5*
SELAWIK D-1*
SELAWIK D-2*
SELAWIK D-4*
SKAGWAY B-2*
SKAGWAY B-3*
SLEETMUTE C-7*

Arizona

BENSON*—Cochise
BISBEE NE—Cochise
BUCKEYE—Maricopa
BUCKEYE NW—Maricopa
CAMERON*—Coconino
CANELO PASS[1]—Santa Cruz
COCHISE*[1]—Cochise
COLLEGE PEAKS*—Cochise
DOUGLAS*—Cochise
DOUGLAS NE—Cochise
EMPIRE MOUNTAINS*—Pima
FORT HUACHUCA[1]—Cochise
HASSAYAMPA—Maricopa
HAT MOUNTAIN*—Maricopa
HOLBROOK*—Navajo
HUACHUCA PEAK[1]—Cochise
KAKA*—Maricopa
MIDWAY*—Maricopa
MONTEZUMA PASS[1]—Cochise
OUTLAW MOUNTAIN—Cochise
PEARCE*—Cochise
PEDREGOSA MOUNTAINS*—Cochise

Arizona-New Mexico

PORTAL*—Cochise
SAHUARITA*—Pima
SWISSHELM MTN.*—Cochise

Arkansas

ACORN—Polk
BOARD CAMP—Polk
CAUTHRON—Scott
FORREST CITY—St. Francis
HAYNES—Lee
HORSESHOE MOUNTAIN—Scott
MENA—Polk
MENA*[2]—Polk
POTTER—Polk
RICH MOUNTAIN—Polk
Y CITY—Scott

Arkansas-Oklahoma

BATES—Scott
BATES*[2]—Scott
LOVING—Le Flore
MOUNTAIN FORK—Polk
POTTER*[2]—Polk
ZAFRA—Le Flore

California

APACHE CANYON—Ventura
BIG MEADOW*—Calaveras
BORREGO MOUNTAIN SE—San Diego
BURNT PEAK—Los Angeles
CHUALAR—Monterey
CUYAMA Peak—Santa Barbara
DEL SUR—Los Angeles
EAST OF CUYAMA RANCH—San Luis Obispo
EXETER*[2]—Tulare
GRAPEVINE[1]—Kern
GREEN VALLEY—Los Angeles
GRIDLEY*[2]—Butte
HEALDSBURG*[2]—Sonoma
LANCASTER WEST[1]—Los Angeles
LINCOLN*[2]—Placer
LION CANYON—Ventura
LITTLE VALLEY*—Lassen
LOCKWOOD VALLEY—Ventura
LODI*—San Joaquin
LONG BARN*—Tuolumne
MORTMAR—Riverside
OLD MAN MOUNTAIN—Santa Barbara
OROCOPIA CANYON—Riverside
PALMDALE—Los Angeles
PETALUMA*[2]—Sonoma
PLEITO HILLS[1]—Kern
RED BANK*[2]—Tehama
RED BLUFF*[2]—Tehama
REYES PEAK—Ventura
RICHARDSON SPRINGS*[2]—Butte
RIVERSIDE*—Riverside
SAN GUILLERMO—Ventura
SAN JOSE*[2]—Santa Clara
SANTA ROSA*[2]—Sonoma
SANTIAGO CREEK—Kern
SAWMILL MOUNTAIN—Kern
SEVEN PALMS VALLEY—Riverside
SILVER LAKE*—Amador
SLEEPY VALLEY—Los Angeles
STOCKTON*[2]—San Joaquin
SUTTER BUTTES*—Sutter
TIN MOUNTAIN*—Inyo
TOPATOPA MOUNTAINS—Ventura
WOODLAND*—Yolo

California-Nevada

GRAPEVINE PEAK*—Nye
LAST CHANCE RANGE*—Inyo
STEWART VALLEY*—Nye

Colorado

BOREAS PASS—Summit
BOTTLE PASS—Grand
CERRO SUMMIT—Montrose
CHAMA PEAK*—Archuleta
ESTES PARK—Larimer
FRASER—Grand
GEORGETOWN—Clear Creek
GOLD HILL—Boulder
GRANBY—Grand
GRIZZLY RIDGE—Montrose
LONGS PEAK—Boulder
McHENRYS PEAK—Larimer
MT. EVANS—Clear Creek
SPAR CITY*—Mineral
SQUAW PASS—Clear Creek
WARD—Boulder
WOLF CREEK PASS*—Mineral

Connecticut

ANSONIA—New Haven
BRANFORD—New Haven
BRIDGEPORT—Fairfield
FITCHVILLE—New London
MILFORD—New Haven
NEW HAVEN—New Haven
NORWALK SOUTH—Fairfield
PLAINFIELD—Windham
SHERWOOD POINT—Fairfield
STAMFORD—Fairfield
WESTPORT—Fairfield

Florida

ALVA SE—Lee
AMELIA CITY—Nassau
BELLE MEADE—Collier
BELLE MEADE NE—Collier
BELLE MEADE NW—Collier
BELLE MEADE SE—Collier
CATHARINE ISLAND—Collier
CORKSCREW NW—Collier
CORKSCREW SW—Collier
FELDA—Hendry
FELDA SE—Hendry
FORT MYERS NW—Lee
FORT MYERS SE—Lee
FORT MYERS SW—Lee
IMMOKALEE—Collier
IMMOKALEE SW—Collier
MADISON SW—Madison
MYAKKA RIVER—Sarasota
SUNNILAND—Collier

Florida-Georgia

GROSS—Nassau

Georgia

ALTAMAHA SOUND—McIntosh
CUMBERLAND ISLAND NORTH—Camden
DANIELSVILLE*—Madison
ISLE OF HOPE—Chatham
JEKYLL ISLAND—Glynn
KINGSLAND NE—Camden
OAK LEVEL—Bryan
RIDGEVILLE—McIntosh
SAVANNAH BEACH SOUTH—Chatham
SEA ISLAND—Glynn
WASSAW SOUND—Chatham

Georgia-Tennessee

EAST RIDGE[1]—Hamilton

Hawaii

HANA—Maui
KEAWANUI BAY—Hawaii
KILOHANA—Maui
KUKAIAU—Hawaii
MAHUKONA—Hawaii

Idaho

BELLEVUE*—Blaine
COEUR D'ALENE*—Kootenai
IDAHO CITY—Boise
KINGSTON*—Shoshone
KUNA—Ada
MAY*—Lemhi
MORA—Ada
PATTERSON*—Lemhi
SHAFER BUTTE—Boise
THORN CREEK*—Gooding

Idaho-Montana

BURKE*—Shoshone
SIMMONS PEAK*—Shoshone

Idaho-Wyoming-Montana

BUFFALO LAKE*—Fremont

Illinois

BETHALTO[1]—Madison
COLLINSVILLE[1]—Madison
EDWARDSVILLE[1]—Madison
FLANAGAN*—Livingston
FREEBURG—St. Clair
LEBANON[1]—St. Clair
MARINE—Madison
MASCOUTAH—St. Clair
MONKS MOUND[1]—Madison
NEW ATHENS WEST—St. Clair
ODELL*—Livingston
O'FALLON[1]—St. Clair
PRAIRIETOWN—Madison
ST. JACOB[1]—Madison
WATERLOO—Monroe
WORDEN—Madison
YORKVILLE*[2]—Kendall

Illinois-Iowa

MILAN*[2]—Rock Island

Illinois-Missouri

ALTON[1]—Madison
BRUSSELS—Calhoun
ELSAH—Jersey
WOOD RIVER[1]—Madison

Indiana

BRISTOW—Perry
CHURUBUSCO—Whitley
COATESVILLE—Hendricks
COLUMBUS—Bartholomew
ELIZABETHTOWN—Bartholomew
FOREST HILL—Decatur
GRAMMER—Bartholomew
GREENCASTLE—Putnam
GREENSBURG—Decatur
HARTSVILLE—Bartholomew
INDIAN SPRINGS—Martin
KOLEEN—Greene
LITTLE YORK—Washington
LYONS[1]—Greene

MILLHOUSEN—Decatur
QUINCY[1]—Owen
ROACHDALE—Putnam
SUNMAN—Ripley
SANDBORN[1]—Knox
SOLSBERRY—Greene
SOUTH BEND WEST—St. Joseph
SPADES—Ripley
STAUNTON—Clay
WESTPORT—Decatur

Indiana-Kentucky

EVANSVILLE—Vanderburgh

Iowa

HOLY CROSS—Dubuque

Iowa-Wisconsin

TURKEY RIVER—Clayton

Kansas

GREAT BEND—Barton
LAKE McBRIDE†—Scott
MOUND CITY—Linn

Kentucky

CALVERT CITY[1]—Marshall
LOUISVILLE*—Jefferson
SHEPHERDSVILLE*—Bullitt

Kentucky-Illinois

LITTLE CYPRESS[1]—Marshall

Louisiana

BAY DOSGRIS—Jefferson
BAY TAMBOUR—Lafourche
CALUMET ISLAND—Lafourche
CAMINADA PASS—Jefferson
DOG LAKE—Terrebonne
FORT NECESSITY*—Franklin
GOLDEN MEADOWS FARMS—Lafourche
GRAND BAYOU DU LARGE—Terrebonne
JACKO BAY—Terrebonne
JENA*—La Salle
LAKE LA GRAISSE—Terrebonne
LEEVILLE—Lafourche
MINK BAYOU—Lafourche
PELICAN PASS—Lafourche
TIMBALIER ISLAND—Terrebonne

Maine

BRASSAU LAKE*[1]—Somerset
BURNHAM*[1]—Waldo
GARDINER*[1]—Kennebec
GREAT POND*[1]—Hancock
KATAHDIN*†—Piscataquis
KENNEBUNK*[1]—York
ROCKLAND—Knox
SOUTH HARPSWELL[1]—Cumberland
STRATTON*[1]—Franklin
THOMASTON—Knox
WISCASSET*[1]—Lincoln
YARMOUTH[1]—Cumberland

Maryland-Delaware

CECILTON[1]—Cecil

Maryland

CHURCH HILL[1]—Queen Annes

Maryland-Pennsylvania

NEW FREEDOM[1]—York

Maryland-Virginia

MOUNT VERNON[1]—Fairfax

Michigan

AU TRAIN*—Alger
GRACE*—Presque Isle
HOUGHTON*[2]—Houghton
MANISTEE*—Manistee
MARQUETTE*[2]—Marquette
SHINGLETON*—Alger

Minnesota

ANOKA*[2]—Anoka
BIG BEND CITY—Chippewa
DEER YARD LAKE—Cook
KERKHOVEN—Swift
MADISON—Lac Qui Parle
MINNEAPOLIS*[2]—Hennepin
MURDOCK—Swift
NEW BRIGHTON*[2]—Ramsey
ROCKFORD*—Wright
ST. PAUL*[2]—Ramsey

Mississippi

CARNES*—Forrest
DEAD TIGER CREEK—Hancock

Mississippi-Louisiana

PICAYUNE*—Pearl River

Missouri

BELGRADE—Washington
BONNE TERRE*[2]—St. Francois
BONNE TERRE—St. Francois
FLAT RIVER—St. Francois
HOUSE SPRINGS—Jefferson
IRONDALE—Washington
MANCHESTER—St. Louis
MAXVILLE—Jefferson
MINERAL POINT—Washington
PACIFIC—St. Louis
PALMER—Washington
POTOSI—Washington
POTOSI*[2]—Washington
ST. CHARLES—St. Charles
SHIRLEY—Washington

Missouri-Illinois

GRAFTON—Jersey
KAMPVILLE—St. Charles
WINFIELD—Lincoln

Montana

GABLE PEAKS—Flathead

Montana-Wyoming

MINER*—Park

Nebraska

COLUMBUS—Butler
COLUMBUS SE—Butler
DANBURY NE—Red Willow
DUNCAN—Platte
FULLERTON NE—Nance
GENOA—Nance
INMAN—Holt
O'NEILL—Holt
PAGE—Holt

Nevada

BOULDER CITY SE—Clark
SINGLETREE CREEK—Elko
SPANISH SPRINGS VALLEY*—Washoe
WADSWORTH*—Washoe

Nevada-California

PAHRUMP*—Nye

New Hampshire

ALTON*[1]—Belknap
HOLDERNESS*[1]—Grafton

New Mexico

BLUEWATER—Valencia
BOX CANYON RANCH—Eddy
DOS LOMAS—McKinley
LAGUNA—Valencia
MOQUINO—Valencia
SEBOYETA—Valencia

New York

ALTAMONT—Albany
BREAKABEEN—Schoharie
ESPERANCE—Schoharie
GALLUPVILLE—Schoharie
KERHONKSON—Ulster
MIDDLEBURG—Schoharie
MOHONK LAKE—Ulster
MONROE—Orange
RANDALL—Montgomery
SCHOHARIE—Schoharie
SYRACUSE EAST[1]—Onondage
TRIBES HILL—Montgomery
WHITE PLAINS[1]—Westchester

New York-New Jersey

NYACK[1]—Rockland

North Carolina

RAINBOW SPRINGS—Macon

North Dakota

ANAMOOSE—McHenry
BALFOUR—McHenry
BALTA—Pierce
BALTA NW—Pierce
BALTA SE—Pierce
BRINSMADES SW—Benson
DRAKE—McHenry
DRAKE NW—McHenry
DRAKE SW—McHenry
FORMAN—Sargent
GOLDWIN—Stutsman
GOLDWIN SE—Stutsman
KIEF—McHenry
ORRIN—Pierce
RUTLAND—Sargent
VASHTI—Stutsman

North Dakota-South Dakota

MARLOW—Marshall
VEBLEN NE—Marshall

Ohio

AMANDA—Fairfield
ASHVILLE—Pickaway
CARROLL—Fairfield
FIVE POINTS—Pickaway
PATASKALA—Licking

Ohio-West Virginia

HUNTINGTON—Cabell
STEUBENVILLE WEST—Jefferson

Oklahoma

DENVER—Cleveland
EASON—Pottawatomie
KEYSTONE DAM—Tulsa
LITTLE AXE—Cleveland
MANNFORD SE—Creek
TRIBBEY—Pottawatomie
WEKIWA—Tulsa

Oklahoma-Texas

HASTINGS*—Jefferson

Oregon

HALSEY*[1]—Linn
LEBANON*[1]—Linn
MODOC POINT*—Klamath
SALEM*[1]—Marion

Oregon-Washington

HOOD RIVER*—Hood River
WHITE SALMON*—Klickitat

Pennsylvania

BEAVER FALLS—Beaver
BUTLER—Butler
EVANS CITY—Butler
GREENFIELD—Mercer
KITTANNING—Armstrong
PITTSBURGH EAST[1]—Allegheny

Pennsylvania-New Jersey

MILFORD—Pike

Puerto Rico

AGUAS BUENAS[1]—Aguas Buenas
CAROLINA[1]—Loiza
PARGUERA[1]—Lajas

South Carolina

LADSON—Charleston
MOUNT HOLLY—Berkeley
NORTH CHARLESTON—Charleston
SUMMERVILLE NW—Berkeley
SUMTER*[1]—Sumter

South Dakota

FORESTBURG NW—Sanborn
HURON NE—Beadle
HURON NW—Beadle
SAINT ONGE*[2]—Lawrence
VALE*[2]—Butte
VEBLEN—Marshall

Tennessee

DAISY[1]—Hamilton
FAIRMOUNT—Hamilton
RAFTER—Monroe
SHOP SPRINGS—Wilson

WATERTOWN—Wilson

Texas
BROADDUS*—San Augustine
BROOKELAND*—Sabine
EDWARDS BRANCH—Stephens
LA SAL VIEJA*[2]—Willacy
LOS FRESNOS*[2]—Cameron
ROSITA LAKE*[2]—Kenedy
SALTILLO RANCH*[2]—Kenedy
SOUTHERLAND CANYON—King

Utah
‡ANETH 1 SW—San Juan
‡ORDERVILLE CANYON NE—Kane

Utah-Arizona
PARIAH*—Kane

Utah-Colorado
‡ANETH 1 SE—San Juan

Virginia
ENDICOTT*—Franklin
FLOYD*—Floyd
FORT BLACKMORE—Scott
INDEPENDENT HILL[1]—Prince William
JETERSVILLE*—Amelia
JOPLIN—Prince William
MACKS MOUNTAIN*—Pulaski
NORTON—Wise
OCCOQUAN[1]—Prince William
POUND—Wise
WISE—Wise

Virginia-Maryland
BELVOIR[1]—Fairfax
QUANTICO[1]—Prince William

Washington
GRAYLAND—Grays Harbor
HORSESHOE BASIN*—Okanogan
HUSUM*—Klickitat
INDEX*—Snohomish
KLICKITAT*—Klickitat
LOOMIS*—Okanogan
SILVERTON*—Snohomish
TIFFANY MOUNTAIN*—Okanogan
WESTPORT—Grays Harbor

West Virginia
BEECH HILL—Mason
BURNING SPRINGS—Wirt
CHARLESTON EAST—Kanawha
CHARLESTON WEST—Kanawha
KENTUCK—Jackson
MILTON—Cabell
REEDY—Roane
ROMANCE—Jackson
SPENCER—Roane
STOTLERS CROSSROADS—Morgan

West Virginia-Maryland
BIG POOL—Washington

West Virginia-Ohio
BARBOURSVILLE—Cabell
VALLEY MILLS—Wood

West Virginia-Pennsylvania
MORGANTOWN NORTH—Monogalia

Wisconsin
AMHERST* (P)—Portage
WAUPACA* (P)—Waupaca

Wyoming
ALKALI BUTTE[1]—Fremont
ARAPAHOE NE[1]—Fremont
BENGOUGH HILL—Albany
DEVILS TOOTH*—Park
HARRIS BRIDGE—Fremont
IRISH ROCK*—Park
McKINNON JUNCTION*—Sweetwater
OCEAN LAKES[1]—Fremont
SUNSHINE RESERVOIR*—Park
YELLOWSTONE RANCH[1]—Fremont

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the United States and Territories are being published and distributed. They may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Alaska
BEETLES†
CHANDLER LAKE†
CRAIG
IKPIKPUK RIVER
SURVEY PASS†

Arkansas-Tennessee-Alabama-Missouri
BLYTHEVILLE

Arizona
TUCSON

Arizona-Mexico
NOGALES

California
WESTWOOD

Colorado
TRINIDAD

Colorado-Utah
CORTEZ

Florida
FORT PIERCE
PLANT CITY
TAMPA

Idaho
HAILEY

Iowa-Nebraska-Kansas
SIOUX CITY

Kansas
PRATT

Michigan
MIDLAND

Michigan-Wisconsin
IRON MOUNTAIN

Missouri
JEFFERSON CITY

Missouri-Illinois
ROLLA

Missouri-Kansas
JOPLIN

Nevada
MILLETT

Nevada-California
LOVELOCK

Nevada-Utah
ELY

New Mexico-Arizona
SHIPROCK

North Carolina
MANTEO[1]

Oregon
BURNS
CANYON CITY

Oregon-Idaho
BAKER

Pennsylvania-New York
WARREN

South Dakota
HURON
MITCHELL

Tennessee-Alabama
COLUMBIA

Tennessee-Kentucky
NASHVILLE

Texas
LAREDO

Wisconsin
GREEN BAY

The following National Park maps are now available:

BANDELIER NATIONAL MONUMENT AND VICINITY, NEW MEXICO. (53 by 42 inches) 1:24,000 scale. $1.50.
CRATER LAKE NATIONAL PARK AND VICINITY,[1] OREGON. (25 by 34 inches) 1:62,500 scale. 75¢.

UNITED STATES BASE MAP. A new wall map showing State and county boundaries and names, State capitals and county seats in black, water features in blue. State boundaries are accentuated by a green overprint. A buff background distinguishes the United States from adjoining countries. Insets show Alaska and Hawaii, and the Canal Zone, Puerto Rico and the Virgin Islands. 1:250,000 scale. Two sheets, each 41 by 51 inches. $1.50 per set.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Mich., at 75 cents per copy. Payment is required in advance by P. O. money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

33.—Coast Chart, Lake Erie. Sixteen Mile Creek, Pa., to 7 miles west of Conneaut, Ohio, at 1 : 80,000 scale. Inset : Conneaut Harbor, Ohio, at 1 : 10,000 scale. (June 1959)

173.—Lake Champlain. Four Brothers Islands to Barber Point, N. Y., at 1 : 40,000 scale. (June 1959)

174.—Lake Champlain. Barber Point, N. Y., to Whitehall, N. Y., at 1 : 40,000 scale. (June 1959)

181.—New York Canals. Champlain Canal from Troy, N. Y., to Whitehall, N. Y., at 1 : 40,000 scale. (July 1959)

187.—New York Canals. Cayuga and Seneca Lakes, N. Y., at 1 :60,000 scale. Insets : Watkins Glen, N. Y., and Ithaca, N. Y., at 1 : 10,000 scale. (July 1959)

332.—Lake Erie. Erie Harbor and Presque Isle, Pa., at 1 : 15,000 scale. (June 1959)

342.—Ashtabula Harbor, Ohio at 1 : 5,000 scale. (June 1959)

364.—Lake Erie. Islands in Lake Erie, including Sandusky Bay, Ohio at 1 : 40,000 scale. Inset : Put in Bay, Ohio, at 1 : 10,000 scale. (July 1959)

365.—Sandusky Harbor, Ohio, at 1 : 10,000 scale. (June 1959)

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between June 1 and August 31, 1959. The class or purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Alabama—Huntsville Meridian

T. 9 S., R. 11 E.—Survey of islands
T. 10 S., R. 8 E.—Survey of islands
T. 10 S., R. 9 E.—Survey of islands
T. 10 S., R. 10 E.—Survey of islands

Alaska

U. S. Survey No. 2881—Small Tracts—Yakutat
U. S. Survey No. 3345—Eyak Addition, Cordova Townsite
U. S. Survey No. 3533—Lakeside Homesite Group
U. S. Survey No. 3541—Coast Guard Reserve—Pt. Higgins
U. S. Survey No. 3556—Island surveys—Sitka Harbor
U. S. Survey No. 3602—Small Tracts—Yakutat
U. S. Survey No. 3611—Port Graham Airport

Arizona—Gila and Salt River Meridian

T. 14 N., R. 4 E.—Subdivision of sections
T. 17 N., R. 5 E.—Dependent resurvey
T. 4 S., R. 23 E.—Extension survey
T. 14 S., R. 32 E.—Dependent resurvey (Part)

California—Mt. Diablo Meridian

T. 29 N., R. 3 W.—Survey of island
T. 36 N., R. 8 W.—Dependent resurvey, part of boundaries
T. 37 N., R. 8 W.—Dependent resurvey, part of boundaries
T. 21 N., R. 16 W.—Subdivision of section

California—San Bernardino Meridian

T. 2 N., R. 5 E.—Extension survey
T. 9 N., R. 13 E.—Skeleton survey
T. 11 N., R. 13 E.—Skeleton survey
T. 12 N., R. 7 E.—Skeleton survey
T. 12 N., R. 8 E.—Skeleton survey
T. 12 N., R. 9 E.—Skeleton survey
T. 13 N., R. 6 E.—Skeleton survey
T. 13 N., R. 7 E.—Skeleton survey
T. 13 N., R. 8 E.—Skeleton survey
T. 13 N., R. 10 E.—Skeleton survey
T. 13 N., R. 11 E.—Skeleton survey
T. 14 N., R. 7 E.—Skeleton survey

Colorado—Sixth Principal Meridian

T. 29 S., R. 69 W.—Subdivision of section
T. 7 S., R. 72 W.—Subdivision of section
T. 5 S., R. 75 W.—Subdivision of section
T. 1 S., R. 78 W.—Subdivision of section
T. 7 S., R. 89 W.—Subdivision of section
T. 1 N., R. 102 W.—Subdivision of section

Colorado—New Mexico Principal Meridian

T. 40 N., R. 3 E.—Subdivision of section
T. 33¼ N., R. 17 W.—Survey (part of subdivisions)

Florida—Tallahassee Meridian

T. 27 S., R. 15 E.—Survey of islands
Ts. 29 & 30 S., R. 17 E.—Survey of islands

Idaho—Boise Meridian

T. 11 N., R. 6 W.—Survey of islands

Louisiana—Louisiana Meridian

T. 20 S., R. 20 E.—Extension survey
T. 21 S., R. 20 E.—Survey of islands
T. 22 S., R. 20 E.—Survey of islands
T. 23 S., R. 20 E.—Survey of islands
T. 22 S., R. 21 E.—Survey of islands

Michigan—Michigan Meridian

T. 41 N., Rs. 1 & 2 E.—Survey of islands
T. 41 N., R. 2 E.—Survey of islands
T. 32 N., R. 4 E.—Survey of islands
T. 42 N., R. 4 E.—Survey of islands
T. 26 N., R. 7 E.—Survey of islands
T. 30 N., R. 4 W.—Survey of islands
T. 27 N., R. 11 W.—Survey of islands
T. 20 N., R. 14 W.—Survey of islands

New Mexico—New Mexico Principal Meridian

T. 26 N., R. 8 W.—Dependent resurvey
T. 27 N., R. 8 W.—Dependent resurvey
T. 22 S., R. 4 E.—Dependent resurvey (part)
T. 13 S., R. 13 W.—Dependent resurvey (part)
T. 12 S., R. 14 W.—Dependent resurvey (part)
T. 17 S., R. 14 W.—Dependent resurvey

Oregon—Willamette Meridian

T. 19 S., R. 1 E.—Dependent resurvey (part)
T. 21 S., R. 4 W.—Dependent resurvey (part)
T. 28 S., R. 4 W.—Dependent resurvey (part)
T. 7 S., R. 7 W.—Dependent resurvey (part)
T. 16 S., R. 7 W.—Dependent resurvey (part)
T. 14 .S, R. 8 W.—Dependent resurvey (part)
T. 31 S., R. 14 W.—Dependent resurvey

Utah—Salt Lake Meridian

T. 37 S., R. 4 E.—Skeleton survey
T. 38 S., R. 2 E.—Skeleton survey

T. 38 S., R. 3 E.—Skeleton survey
T. 38 S., R. 4 E.—Skeleton survey
T. 38 S., R. 5 E.—Skeleton survey
T. 39 S., R. 3 E.—Skeleton survey
T. 39 S., R. 4 E.—Skeleton survey
T. 39 S., R. 5 E.—Skeleton survey
T. 40 S., R. 3 E.—Skeleton survey
T. 40 S., R. 4 E.—Skeleton survey
T. 40 S., R. 5 E.—Skeleton survey

Wyoming—Sixth Principal Meridian
T. 14 N., R. 84 W.—Subdivision of section

County General Highway Maps

THE FOLLOWING county general highway maps were received by the U. S. Bureau of Public Roads, Washington, D. C., during the period from June 1 to August 31, 1959. Copies of these maps are sent to the Washington office as part of the continuing cooperative Federal-State highway planning program, as they are completed or revised by the State highway departments.

Inquiries concerning prices, and orders should be sent to the respective State highway departments and not to the U. S. Bureau of Public Roads.

Colorado
DENVER AND VICINITY
LAS ANIMAS
LOGAN
PHILLIPS
SEDGWICK

Florida
CITRUS
HENDRY
LAFAYETTE
MADISON

Idaho
FRANKLIN
LINCOLN

Kansas
BOURBON
GEARY
GREENWOOD

Louisiana
ASSUMPTION
JEFFERSON
PLAQUEMINES
POINTE COUPEE
ST. BERNARD
ST. TAMMANY
TANGIPAHOA

Maine
ANDROSCOGGIN
AROOSTOOK
HANCOCK
KENNEBEC
KNOX
OXFORD
PENOBSCOT
SOMERSET
WALDO

Maryland
CHARLES
SOMERSET

Mississippi
FOREST
HANCOCK
PEARL RIVER

Missouri
ADAIR
BARTON
BOLLINGER
CARROLL
CHRISTIAN
OREGON

North Dakota
ADAMS
BENSON
DICKEY
HETTINGER
LA MOURE
LOGAN
McINTOSH
MOUNTRAIL
WELLS

New Mexico
COLFAX
HARDING

Oregon
DOUGLAS

Pennsylvania
CAMERON
FAYETTE
LAWRENCE
SUSQUEHANNA
WAYNE

South Dakota
LYMAN
MEADE
MELLETTE
PENNINGTON
STANLEY

Tennessee
CHEATHAM
LAWRENCE
WAYNE

Utah
DUCHESNE
GRAND
UINTAH
WASHINGTON

Washington
WHITMAN

Nachrichten aus dem Karten-und Vermessungswesen

(Information relative to Cartography and Geodesy)

Series II: German Contributions in Foreign Languages, No. 3* and No. 4* contain the following papers:

I. User Requirements and Map Design
II. Map Compilation and Drafting
III. Typing and Stick-up
IV. Corrections and Revisions
V. Cartographic Relief Representation
VI. Reproduction Processes
VII. Education and Training
VIII. International Cooperation

Already published in German as Series I, Nos. 7 to 11, the papers from the Second International Cartographic Conference held at Northwestern University (Evanston/Chicago, U.S.A.) under the auspices of Rand McNally & Co., Chicago, Ill., in accordance with the U. S. mapping authorities and the Congress on Surveying and Mapping are to be published by the Institut für Angewandte Geodäsie, Frankfurt a.M., in accordance with the Rand McNally & Co.

Also previously published as Series II, No. 2, are 25 lectures in their original languages, from the Esselte Conference on Applied Cartography, held in Stockholm in July 1956. Published, Frankfurt a.M., 1958.

Further information regarding these publications may be obtained by writing to the attention of Dr.-Ing. Erwin F. Gigas, Director, Institut für Angewandte Geodäsie, Frankfurt a.M., Germany.

—WALTER S. DIX

* Published in English. Others in preparation. Frankfurt a.M., April 1959.

Comment and Discussion

METRIC SYSTEM IN THE UNITED STATES

PAUL VAN BUSKIRK*—The enclosed brown copies of pages from your last [June 1959] issue show some of the difficulties in the use of two systems in One World.

The blue copy is from my letter attached to the Geophysical Union's questionnaire.

I resent their implication that "all" engineers favor the metric system. That implies that "all" engineers lack a liberal education and are merely stereotype school products.

How can a thinking man accept a system that fails to give a workable division of the circle? The 400-part circle is a monstrosity. The 1000-part circle was adopted by our military people over 100 years ago and soon rejected as unworkable!

Where do months fit into the decimal system?

How can time measurement be decimalized?

Why is concordance between linear units and water weight considered to be of so much importance? What was important in a primitive society may be of no moment under present conditions. Our cubic foot of water contains 1000 ounces so our ounce is the cube of the tenth of a foot. So what!

The important consideration is that our ounce has remained practically constant since Roman times, when it was exactly twice the weight of the Hebrew shekel and had a simple ratio to the weights of antiquity.

If a small part of the time and energy devoted to pushing the metric system could be channeled into setting our own house in order, there would be no problem.

EDITOR'S NOTE.—Mr. Van Buskirk's comments on the "brown copies" referred to in the above letter are substantially as follows: (All references are to SURVEYING AND MAPPING June 1959, Vol. XIX, No. 2.)

Page 273, column 2, last three lines: "Not true" that the *principal* reason was that the effective date proposed was entirely too soon after the passage of the bill.

Page 274 near the middle of the page where the "ornaments" are located, we find this note: "Children are now taught the metric system and understand it. They do not understand the English system thoroughly."

Page 297 column 2, lines 8 and 9: The following note was added: "Were abolished in 1875 by the British Parliament. Only the *ounces* are legal in either Britain or U.S.A."

Page 297, column 2, in commenting on the U. S. and Imperial gallons, Mr. Van Buskirk comments: "Our U. S. gallon is the Queen Anne gallon. It was the volume of a 7-inch cylinder exactly 6 inches deep, 294 *cylindrical* inches, until our Congress changed it very slightly to be 231 *cubic* inches."

On the same page we also find the note: "The Imperial gallon was a 'compromise,' to get free from local gallons. They had no right to retain the name 'gallon'."

The following is the statement referred to as the "blue copy."

Take a Hand in Science

The evolution of the human brain would not have been possible without the hand. We marvel at the dexterity manifested by the fingers and opposed thumb, and rightly so. But we still fail to use the hand to its greatest capacity. It expresses a number system by its twelve phalanges, each of which can be enumerated by the opposed thumb. Each phalanx can be a unit, a dozen, or any power of twelve. Mathematicians know that these dozenal [duodecimal] numbers are inherently vastly superior to decimal numbers. Twelve has the factors 2, 3, 4, and 6, repeated in 4, 6, 8, 9, and 10. Ten has the factors 2, and 5, and only 2 repeats. These act as "gears" in the counting machine.

The tip phalanges each measure about one inch and the total length of the twelve phalanges is about one foot. These standards were established in the Roman period and were passed on to the English. The cubic foot of water weighed 1000 ounces, and it is their ounce we use today.

Unfortunately, the Hindu abacus only had ten places so the zero concept for the empty

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space, sunya, became identified with ten numbers, though it is a universal concept, adaptable to any number as a base. It came to us through the Arabic revival, but the decimal fraction was not recognized until 1585. Simon Stevinus set forth the idea and in the same paper remarked that it was too bad there were not twelve numbers instead of ten!

Since his time decimal units have been proposed, adopted, discarded, reappeared, made compulsory by the French Revolutionists, by Hitler, by Stalin, and lately by the Chinese. We are told that decimals are "Scientific" even though they originated with toe counting aborigines! But decimals had to be discarded in favor of the two-figure binaries before an electronic computer could be produced. It is the place value concept that is scientific not the limited use of it with only ten symbols.

This dozenal mathematics idea is being advanced by independent thinkers from several parts of the world. Creativity has always manifested its truths to many thinkers at about the same time. Victor Hugo once said, "There is nothing so irresistable as an idea whose time has come."

The Free World could gain unquestioned scientific leadership by pushing place value up to twelve, evolving a superior weights-and-measures system in existing inches, ounces, hours and months, thereby relegating the whole decimal system to the same position now occupied by the Gunter's Chain, the first decimal tool!

VELOCITY

LANSING G. SIMMONS*—Reference is made to an article, "Needed: New Velocity Measurement Unit for Space," by Major William C. Mannix, U.S.A.F., which appeared in the April 27, 1959, issue of *Missiles and Rockets*.

Because velocity is expressed in so many different units, such as miles per second, miles per hour, kilometers per second, feet per second, etc., the author of the above-mentioned article is "tempted to brush them all aside and start afresh." His proposal for the unit of velocity is the "Optik" to which he assigns a value of 300 meters per second, nearly (but not quite) one millionth the speed of light.

No one can lightly brush aside the variety of units used to express velocity, and to add another is certainly not going to help the situation. Actually, the "Optik" is based on the c.g.s. system with a factor of three thrown in. The fact that the meter, and thus the kilometer, was originally based on the length of the terrestrial meridian should not automatically outlaw it as a unit in space.

The intermediate step, suggested by the author, of converting all high velocity work to kilometers per second should, in my mind, be considered the final step.

* Coast and Geodetic Survey, Washington 25, D. C.

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Fifty Years of Aviation Cartography

As reported in the September 1959 issue of *Surveying and Mapping* (p. 377) there was opened in Munich, Germany, on September 25, 1959, an international exhibit of aeronautical charts entitled "Fifty Years of Aviation Cartography." In conjunction with the exhibit there was published, by West Germany's Institut für Angewandte Geodäsie (Frankfurt a.M.) a guidebook entitled "Beiträge zur Geschichte der Luftfahrtkarte." Compiler of the guide, and chairman of the committee arranging the exhibit, is Karl-Heinz Meine of the Bundesanstalt für Flugsicherung.

The publication includes a running description of the exhibited items, which is in essence a summary history of air charts. Supplementing the text is a comprehensive bibliography of references relating to aeronautical charts. The bibliography, compiled under the direction of Mr. Meine and U. Tannhausen-Panzeram, includes contributions from collaborators in more than twenty countries.

The Foreword to the booklet notes that "the international exhibition '50 Years of Aviation Cartography' is an excellent opportunity to review and show the achievements and, simultaneously, to direct the attention towards the future. . . . Not the cartographique techniques as such, but nature, purpose, and function of

(Continued on page 521.)

News of Related Organizations

Indiana Society of Professional Land Surveyors

The following items from the September 1959 issue of the *Surveying and Mapping Newsletter*, issued by the Indiana Society of Professional Land Surveyors—Division of Adult Education, Purdue University, Lafayette, Indiana—Ken S. Curtis, Editor, have been reprinted in the belief that they will be of interest generally to the readers of SURVEYING AND MAPPING.

—EDITOR

The Fall Meeting of Committees, a working session for the twelve committees of the ISPLS, was held at Turkey Run State Park, October 23–24, 1959.

The Indiana Society of Professional Land Surveyors and the Indiana County Engineers and Surveyors Association held their Annual Picnic at the 4-H Club Building at Paoli, Indiana, Sunday afternoon, August 2, 1959. From 12:30 to 2:00 p.m., approximately 90 members and guests were served a delicious chicken dinner with all the trimmings.

After the dinner we were entertained by the five very talented children of Mr. and Mrs. Lewis Captain, of Bluffton Indiana. Included in their program was a variety of vocal, piano, and accordian numbers, which were received by all with a great deal of enthusiasm.

After remarks by Charles Smith, President of the ICE&SA, and by George Crowder, President of the ISPLS, we were then introduced to Mrs. Floyd Atkinson, Past Regent of the Lost River Chapter of the D.A.R., an organization that has long recognized and publicized the intersection of the Base Line and Second Principal Meridian as a most important historical site in the State of Indiana and who has done a vast amount of ground work in bringing this intersection point, commonly known as the Initial Point, to the attention of the citizens of Indiana. Her remarks concerning an account of their work and efforts was most interesting and encouraging.

We were then introduced to James Tucker, Attorney, of Paoli, Secretary of State for Indiana in 1938 and 1942 and who is at present Chairman of the Department of Conservation. His remarks were directed primarily to the part the Conservation Department had and will play in the establishment of monuments at the Initial Point. A most pleasant surprise announcement was made by Mr. Tucker that the Paoli Business and Professional Women's Club had voted a donation of $500.00 to assist in the erection of an appropriate monument.

A letter from State Senator Ruel W. Steel of Bedford was read, stating his regrets at not being able to attend our picnic and his pleasure at having been given the chance to sponsor H. B. 212 in the Senate. Also that it was very appropriate and our Society and Association should be commended as the motivating source.

Then Representative John L. Prentice, of Paoli, retired minister of the Presbyterian Synod, our principal speaker for the afternoon, spoke on the early trails and surveys in southern Indiana, and House Bill No. 212 which he introduced and which set up $1,000.00 for the establishment of the monuments and improvements at the Initial Point. He spoke of trials and tribulations in steering this Bill through the House during the 1959 Legislature. Representative Prentice's talk was very interesting and enlightening, and we are deeply appreciative of his assistance and efforts.

After the meeting a few who were anxious to start their long trip homeward departed, and a caravan of about 20 cars, with about 55 members and guests, started south of Paoli on State Road 37 to visit the Initial Point. Unfortunately most of the cars were separated going through Paoli and it took "quit a bit of doing" to get together again. Then, leaving State Road 37 at a point about seven miles south of Paoli, we turned west across the Northwest Quarter of Section No. 6, Township 1 South, Range 1 East, and across the Southwest Quarter of Section No. 31, Township 1 North, Range 1 East, crossing the Base Line and over the land of Mr. and Mrs. Wilbur Tarr, to a point about 500 feet north of the Initial Point, where we parked our cars. The last 500 feet was made on foot down a long slope to the most important corner in the State of Indiana, the intersection of the Base and Second Principal Meridian (or Initial Point).

After the hot, thirsty group (of about 55) had observed the Stone at the Initial Point and had consumed three gallons of pink lemonade, a movie was made depicting two little Indian children (Mark Jacobi and his little Indian Sweetheart), an Indian brave (Nelson Prall) using his trusty bow and arrow, and old Trail Scout (Charlie Smith) with his Ball & Cap Muzzle Loader, an Axman (C. B. Wood), Chainmen (Alfred Forgey and George Crowder) and then the Surveyor (Joseph Jacobi) with his compass.

Those taking part as Indians were properly painted and feathered. The Survey group wore red, black, gray, and blond wigs, beards and mustaches. They were really a sight to see. . . .

After the movie making, Joseph Jacobi, Hugh Buercklin and others established a reference line to true meridian north from the stone at the Initial Point. Then after a lot of Survey talk, general gossip, gabbing, and farewells, we all found our way back across Mr. Tarr's land to State Road 37 and home.

Although it had been planned to have a dedication of a monument at the roadside and at the Initial Point, this had to be cancelled due to lack of time in working out the details with the Department of Conservation. Also the obtaining of a right-of-way from State Road 37 over Mr. Tarr's land to the Initial Point is a problem difficult to solve. . . .

The Eighth Annual Indiana Land Surveyor's Conference will be held on the Purdue University campus on Friday and Saturday, January 15 and 16, 1960. It is highly likely that a special intensive one-day short course will be held on the Thursday preceding, January 14th. . . .

The Indiana Society of Professional Land Surveyors has published their 1959 Yearbook-Directory, a 36-page booklet of pocket size, which contains lists of officers, directors, committee chairmen, and committee asignments; an alphabetic listing of members, a geographic listing of members, history of the society, list of past officers, constitution, canons of ethics, schedule of minimum surveying fees, and technical standards for land surveying.

Georgia Association of Registered Land Surveyors

The first regular meeting for the 1959–1960 year of the Georgia Association of Registered Land Surveyors was held in Atlanta at the Architects-Engineers Building on September 26, 1959. Objective programming for the year was the main topic.

The GARLS is sponsoring a course in Photogrammetry for its members under the tutelage of Professor J. O. Eichler of the Georgia Institute of Technology. Meeting once a month for the next seven or eight months in the Civil Engineering building at the Institute sessions of two and one-half to three hours will be held on Saturday mornings. Enrollment is limited to sixteen persons, with a fee of $15.00 per person for the course.

Connecticut Valley Association of C. E. & L. S.

The Connecticut Valley Association of Civil Engineers and Land Surveyors' meeting of May 18, 1959, was held at Tod Morden Lodge, Cummington, Mass. This was a ladies-night meeting at which a lecture, illustrated with colored slides, was given on a coast-to-coast trip. Members of the Berkshire County Association were guests.

The meeting of September 21, 1959, was held at the Yankee Pedlar Inn, Holyoke, Mass. The theme or program was listed as "Rededication of purpose of the Connecticut Valley Association and renewal of effort to support same."

A "notice" at the bottom of their *Newsletter* of September 18, 1959, strikes us as worth quoting. It read, "It takes a quorum to make a meeting official—but it takes you all to make any organization successful."

Surveying and Mapping Division, A.S.C.E.

In connection with the 1959 Annual Convention of the American Society of Civil Engineers, held in Washington, D. C., October 19–23, 1959, the Surveying and Mapping Division of that organization held two meetings. The first, held during the afternoon of October 21st, comprised a panel discussion of "Surveying and Mapping Problems of Our 49th and 50th States," with Robert H. Randall serving as moderator. The panelists were: Franklin K. Van Zandt, U. S. Bureau of Land Management, Washington, D. C.; Reynold E. Isto, U. S. Geological Survey, Fairbanks, Alaska; Lansing G. Simmons, U. S. Coast and Geodetic Survey, Washington, D. C.; and James M. Dunn, Surveyor, Hawaii Survey Department, Honolulu, Hawaii.

The second meeting, held during the afternoon of October 22nd, comprised two papers and a panel discussion. The first paper, "Land Subsidence Over Large Areas as Shown by High-Order Leveling," was given by Captain John H. Brittain, U. S. Coast and Geodetic Survey, Washington, D. C. Colonel Floyd W. Hough, Consulting Geodetic Engineer, Geonautics, Inc., Washington, D. C., spoke concerning "New Tellurometer Systems." The panel discussion, "Implementation on Status of Surveying and Mapping Profession," with James A. Cotton, Consulting Engineer, Dallas, Texas, serving as moderator, featured the following panelists: Brother B. Austin Barry, Associate Professor of Civil Engineering, Manhattan College, New York, N. Y.; Alfred O. Quinn, Chief Engineer, Aero Service Corporation, Philadelphia, Pa.; and George D. Whitmore, Chief Topographic Engineer, U. S. Geological Survey, Washington, D. C.

Earle J. Fennell, Vice Chairman, Surveying and Mapping Division, A.S.C.E., presided over both meetings.

Massachusetts Association of L. S. & C. E.

The Massachusetts Association of Land Surveyors and Civil Engineers held its Fifth Meeting at the Hotel Kenmore, Boston, Mass., December 11–12, 1959.

Minnesota Land Surveyors Association

Application for affiliation as an institutional member of the ACSM has been received from the Minnesota Land Surveyors Association.

Texas Surveyors Association

Affiliation of the Texas Surveyors Association as an institutional member of the ACSM was approved by the Board of Direction, ACSM, at its meeting in Los Angeles, California, October 31, 1959. The motion for approval was presented by Director E. D. Morse, Houston, Texas, and carried unanimously.

SURVEYORS!

Save time

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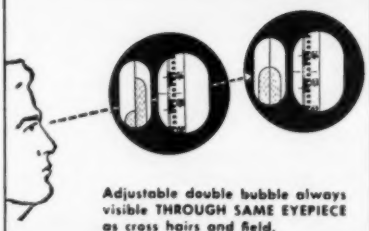

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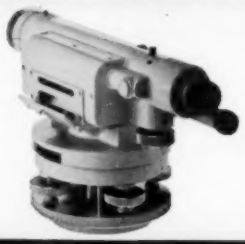

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Congress News

Northern California Section

The Northern California Section, ACSM, met in Room 100, Science Building, San Francisco City College, at 8:00 p.m., Friday, October 9, 1959. Logan N. Muir, Jr., of the Sacramento firm of Packard, Muir and Train, was the guest speaker—his subject, "Sherlock Holmes Finds a Corner."

Election of Officers for 1960-61 Period*

The Nominations Committee appointed by President George C. Bestor has reported as follows:

Your committee on nominations for officers and directors for the year 1960–1961 begs to submit the following report which, in conformity with recent practice, is a single slate. In view of the size of the organization, the diversity of interests of the members, and their wide geographical distribution—no other course appears advisable.

For President
Rear Admiral H. Arnold Karo

For Vice President
Brother B. Austin Barry

For Directors
Ralph Moore Berry
Duncan M. Fitchet
Victor H. Ghent
Roland H. Moore
Alfred O. Quinn

We sincerely believe that this group, together with the directors who were elected in 1959 and the ex-officio members of the Board of Direction, will give an able and truly representative group to direct the Congress during the ensuing year. All have been contacted and have indicated a willingness to serve.

Respectfully submitted,

R. H. Lyddan
L. C. Higbee
W. B. Williams
Chairman

* Annual Meeting through Annual Meeting.

Composition of Proposed ACSM Board of Direction for 1960–1961

	Origin	Present Location	Agency	ACSM Division
Karo	Nebr.	D.C.	USC&GS	Control
Barry	N.Y.	N.Y.	College	Ed.
Bestor	Minn.	Calif.	P.P.*	P.S.
Aggeler	Calif.	Calif.	College	Ed.
Cude	Tenn.	D.C.	C. of E.	Inst.
Law	S. Dak.	D.C.	USGS	Cart.
Thorpe	Ga.	Va.	Com'l.	Inst.
Webb	La.	D.C.	AMS	Topo.
Williams	Mich.	Mich.	P.P.*	P.S.
Moore	Colo.	D.C.	USGS	Control
Ghent	Md.	Va.	P.P.*	P.S.
Berry	Md.	Mich.	College	Ed.
Quinn	N.Y.	Pa.	P.P.*	Topo.
Fitchet	Mass.	Ill.	Com'l.	Cart.

Plus Executive Secretary Dix, Treasurer Hemple, and Editor Rappleye.

* Indicates private practice.

For the reason that these nominations were completed at a date so close to the deadline for this issue of Surveying and Mapping, the usual brief biographies for all candidates have not been included. However, previously published biographies, not completely up to date as of this writing, may be found in previous issues of Surveying and Mapping, as follows:

Karo—Vol. XVIII, No. 4, page 477.
Barry—Vol. XV, No. 4, page 497.
Berry—Vol. XVII, No. 4, page 452.
Fitchet—Vol. XVII, No. 4, page 452.
Ghent—Vol. XVII, No. 4, page 452.

Biographies for Moore and Quinn follow.

ALFRED O. QUINN

Following graduation as a Civil Engineer at Syracuse University, Mr. Quinn joined the Tennessee Valley Authority and was involved in a wide variety of photogrammetric mapping and field survey work in connection with the design and layout of construction. Later he was Assistant to the Head of the Maps and Surveys Division, assisting in the coordination of the engineering work of that Division. He received the LLB degree from the Chattanooga College of Law in 1940.

As an officer in the Navy, he was assigned to the Photographic Intelligence, Naval Gunfire and Amphibious Operations in the Pacific. He served as Assistant to the Director of Photography for the Atomic Bomb Tests in the summer of 1946. He was awarded a Navy commendation.

From 1946 to 1950 he was an Associate Professor in the Department of Civil Engineering, Syracuse University. He is coauthor of a textbook, "Elements of Photogrammetry."

Since joining Aero Service Corporation in 1950, Mr. Quinn has been responsible for the direction of the engineering, photogrammetry and field surveys divisions. As Chief Engineer, he is involved in planning, estimating and technical operations of a wide variety of engineering and mapping services, including design of survey maps and geophysical services, to meet the needs of State and Federal government agencies, foreign governments, and national and international engineering firms. He is responsible for the development of photogrammetric instruments and new applications of electronic systems, such as Shoran, Hiran, airborne profile recorder, Doppler, and the Tellurometer, for the solution of photogrammetric and geodetic problems.

In 1953 he was President of the American Society of Photogrammetry. He is a member of the American Society of Civil Engineers. He is registered as a Professional Engineer in Pennsylvania, Utah, Virginia, Wisconsin, and Alaska; as a Land Surveyor in New York, Washington, and Utah; and is licensed to practice law in Tennessee.

ROLAND H. MOORE

Roland H. (Smokey) Moore received the B.S.C.E. degree from the University of California in 1930. After a short period with California State Highways Division, he joined the U. S. Forest Service in 1933. In 1936 he joined the U. S. Geological Survey.

During his service with the Geological Survey he has held the positions of Chief, Photogrammetry Section, for both the Atlantic and Pacific Regions; Chief, Field Surveys Section, Rocky Mountain Region and Alaska; and is presently the Assistant Chief Topographic Engineer for Research and Technical Standards.

He has been active in various surveying and mapping organizations, having been a Director and later President of the Rocky Mountain Section of the American Society of Photogrammetry. He has been a Director, Secretary-Treasurer, Vice Chairman, and Chairman of the Northern California Section of the ACSM. He has also been Chairman of the Topographic Division of ACSM. In addition he has served as Secretary-Treasurer and Chairman of the Engineering Council of the Sacramento Valley in California, and he is presently Chairman of the Committee on Research and Development of the Surveying and Mapping Division of the American Society of Civil Engineers, as well as Chairman of the ACSM-ASP Cooperation Study Committee for the ACSM.

His teaching experience includes service as an instructor in Engineering Drawing, University of Chattanooga, Summer Session, 1942, and Topographic Drafting (National Defense Training Courses) at George Washington University, May 1943 to May 1945.

New Mexico Section

At a meeting held June 12, 1959, the New Mexico Section of the American Congress on Surveying and Mapping approved its Constitution and Bylaws and elected the following interim officers and directors:

Chairman—Robert B. Stephenson
First Vice Chairman—John W. Shearman
Second Vice Chairman—D. T. Morrison
Third Vice Chairman—Gerald Huffman
Secretary—A. Everitt Ross
Treasurer—Herbert G. Koogle
Directors—H. C. Cain, Jerry R. Bohannon, Robert K. Walsh, Marvin C. May, and Ben Williams.

The charter of the New Mexico Section, ACSM, was approved by the Board of Direction, ACSM, in session October 31, 1959, during the Western Regional Conference of the ACSM, held at Los Angeles, California.

St. Louis Section

As of September 14, 1959, two meetings of the directors of the St. Louis Section, ACSM, had been held with the primary purpose of developing plans for the 1959–60 fall, winter, and spring seasons. The Membership Committee is initiating a program of checking on the status of members and recruitment of new members. The Program Committee has plans for six meetings, with the first one tentatively scheduled for October 20, 1959. Past Chairman Frank Clemens is developing a budget for the year's planned operations, and Louis T. Bernero has been requested to continue the Section Newsletter begun by former Editor Hall last year.

The St. Louis Regional Society of the American Society of Photogrammetry and the St. Louis Section of the American Congress on Surveying and Mapping held a joint meeting the evening of September 23, 1959, in the ACIC cafeteria. Mr. Russell K. Bean of the U. S. Geological Survey gave an enlightening and interesting talk on the research and development activities of that agency. The rest of the program was given over to a spirited discussion of the current proposal to amalgamate the two societies, both so influential in the mapping and charting field. Mr. William A. Radlinski, representative for the ASP on the National Amalgamation Study Committee, presented findings of the committee to date. The meeting was opened by Thomas C. Finnie, Chairman of the St. Louis Section, ACSM, and was closed by R. J. French, President of the St. Louis Region, ASP. Robert H. Kingsley, Technical Advisor to the Commander, ACIC, introduced the speakers.

Mr. Radlinski is the Chairman of the ASP Amalgamation Study Committee. However, Roland H. Moore, also of the U. S. Geological Survey, and Chairman of the ACSM group that is studying the possibilities of consolidating the two groups, had asked Mr. Radlinski to present the ACSM side of the story as well as the ASP version. This Mr. Radlinski did in an entirely impartial manner.

Hawaii Section

The formative Hawaii Section of the ACSM, reporting through its temporary Chairman, James M. Dunn, who is the Surveyor of the State of Hawaii, indicates that with the territorial statehood bills and elections behind them, the ACSM members out there can now turn their attention to committee matters on the preparation of the constitution and election of officers leading to completion of the Charter for the Section. It is expected that this action will go forward rapidly.

At a meeting held October 1, 1959, the assembled members of the American Congress on Surveying and Mapping resident in Honolulu adopted a constitution and elected officers of the Hawaii Section, ACSM.

The officers elected in accordance with the adopted constitution and bylaws are:

Chairman—James M. Dunn
Vice Chairman—Henslee Towhill
Secretary-Treasurer—Gilbert K. Minn
Editor—A. Frankhauser
Director—Clarence J. Olds
Director (one year)—Marcellino Correa

—James M. Dunn
Chairman

James M. Dunn, Chairman pro tempore of the Hawaii Section, ACSM, who is the Surveyor of the State of Hawaii, visited with Executive Secretary Dix in Washington, D. C., during the convention of the American Society of Civil Engineers, October 19–23, 1959.

Many ACSM members, who are also members of the ASCE, heard Mr. Dunn present an interesting panel paper about Hawaiian surveying problems on "Surveying and Mapping Problems of Our 49th and 50th States" which was featured on the program of the Surveying and Mapping Division, ASCE.

Action completing the final approval for the charter of the Hawaii Section, ACSM, was taken by the ACSM's Board of Direction in session October 31, 1959, during the Western Regional Conference, ACSM, at Los Angeles, California.

Southern California Section

The Los Angeles City Hall was the location of the September 11 meeting of the Southern California Section of the ACSM. Several members from the San Bernardino area were in attendance.

James Robinson of the Title Insurance and Trust Co., Los Angeles, spoke on "American Title Association (ATA) Surveys and Special Policy Surveys for Use by Title Companies."

"Survey Analysis Problems" was the topic chosen by A. C. Johnson of the Los Angeles County Engineers and Surveyors Office. A lively discussion ensued on the positioning of a quarter corner from a witness corner and the method of locating the line to the section corner, but the main point, *analyze*, was well received.

On September 26, the Section sponsored a meeting at San Diego State College. The first speaker, C. M. Brown of San Diego, spoke of trouble spots in San Diego County, with particular reference to the intersection of Rancho boundaries with section lines.

Charles R. Herr, Pasadena City College, spoke of the survey courses offered at Southern Cali-

fornia colleges and pointed out that a four-year program should fit very well into the curricula at one or more of the many State Colleges recently organized or soon to be started.

"The Development of the State Coordinate System in San Diego County" was discussed by James A. Isbell, Location Engineer, County of Los Angeles. He explained that as each net is completed a record of survey is filed showing the net and appurtenant data.

William C. Wattles served as moderator of the program and also spoke on the organization of the ACSM. The question of a San Diego Section was discussed, and a committee formed to consider the matter.

—James W. Robinson
Section Editor

Alaska

Exchange of correspondence between ACSM member Charles L. Parker, Anchorage, Alaska, who is spearheading activity toward formation of an Alaska Section of the ACSM, and Membership Chairman Borden of ACSM's central office indicates that ACSM membership in Alaska has built up to qualification strength and that petition activity is about to get under way.

Cartography Division

The Cartography Division of the ACSM held its fall meeting during the evening of November 5, 1959, at the Department of the Interior Auditorium in Washington, D. C.

Dr. Paul A. Siple, scientific leader of the first group to winter at the South Pole, in a talk entitled "90° South," gave a firsthand account of that historic winter and described discoveries significant to the mapping of Antarctica. The talk was illustrated by showing many magnificent color slides.

North Carolina Section

The second regular meeting of 1959 for the North Carolina Section was held in Greensboro, N. C., at the Sedgevield Inn on Thursday, June 18, with Chairman Robert P. Guarino presiding.

Chairman Guarino announced the appointment of a Technical Standards Committee to function jointly with the Technical Standards Committee of the PS&M Functional Section of the Professional Engineers of North Carolina. The committee will consist of Charles A. Harrison, *Chairman,* Ronald Scott, and John G. Bane. A Minimum Fee Committee to function jointly with a like committee of the PS&M Functional Section of PENC was also appointed. The basis of the fees is to be minimum hourly rate, minimum job, land value, and precision. John Gove, *Chairman,* Jerry Mitchell, and Ralph Scott were appointed as members of this committee.

Robert G. Bourne gave a summary report of the Commission for the Study of a Uniform Map Law, outlining legislation enacted as a result of the report of the Commission. On motion of Ronald Scott, seconded by Mr. Tyson, the Section voted unanimously to write a letter of appreciation and commendation to the members of Commission.

—W. Thompson Cox
Secretary

Western Regional Conference

The Second Western Regional Conference of the American Congress on Surveying and Mapping, held at the Statler Hilton Hotel, Los Angeles, California, October 28–31, 1959, was a huge success. Between 300 and 400 persons attended every session of the interesting program.

Wednesday, October 28th, was devoted to registration, exhibits, and a Vendors Cocktail Party which was held in the Los Angeles Room from 5:30 to 7:00 p.m.

Thursday, October 29th, two sessions for the presentation of papers were held. The morning session comprised a paper by Tracy Atherton, Coordinator of Mapping and Surveying, California Department of Water Resources, and a paper by Dr. Robert Stone, Consulting Geologist, Los Angeles, California.

Mr. Atherton's paper presented the control survey problems involved in the vast Feather River Project. The control surveys for this project are complicated by the presence of active faults and the ever-present hazards of earthquakes and attendant land shifts.

Dr. Stone, in discussing the subject "Surveying —Cornerstone of the Science of Geology," presented information regarding the dependence of geology on surveying and mapping.

At the luncheon, held in the Golden State Room, the speaker was Executive Secretary Walter S. Dix. He discussed the aims and purposes of the American Congress on Surveying and Mapping in the past, at present, and for the future.

At the afternoon session, "Survey Standards and Regulations" were discussed by Czerny Anderson, Licensed Surveyor, Fallbrook, California,

and William A. White, Executive Dierctor, California Council of Civil Engineers and Land Surveyors.

Mr. Anderson's problems included the use of trees, 300 feet high, for transit setups, and Indians taking his iron-pipe markers for use in tethering grazing horses and then leaving them firmly imbedded in the ground far from their surveyed positions. On the serious side, Mr. Anderson's talk stressed the need for more uniformity in the preparation of survey records. He referred to manuals of standard practice and symbolization, published from time to time by various agencies, which could well be studied for possible adoption of adequate standards for boundary surveys and the records thereof.

Thursday evening was left open for a special "night on the town."

The morning session on Friday, October 30th, was given over to two papers. The first, by Lyle E. Jones, Cadastral Engineer, Bureau of Land Management, presented Alaska's property survey problems, which are complicated and magnified by accelerated property occupation and ownership claims in that State at this time when basic control is far from adequate.

The second paper, by James P. Webb, Chief, Department of Cartography, Army Map Service, discussed "Army Map Service Activities" and stressed the work of the Army Map Service and its importance to modern requirements for precise positioning on the earth and in outer space. That this paper was well received was evidenced by an active question-and-answer session which ran considerably overtime through the noon recess period.

The afternoon session comprised two papers: "Problems in Photogrammetry," by L. L. Funk, Photogrammetric Engineer, California Department of Public Works; and "Interim Report of Southern California Joint Apprenticeship Committee," presented by F. W. Pafford, President, Pafford and Associates.

Mr. Funk discussed the practice of the California Division of Highways in obtaining photogrammetric mapping. Emphasis was placed on improvements in techniques and contract procedures developed by map checking with the stereoplotter.

Mr. Pafford's paper discussed an apprenticeship program, sponsored jointly by the California Council of Civil Engineers & Land Surveyors and the International Union of Operating Engineers, Local 12 D, being started to guarantee qualifications of persons serving as Party Chief, Head Chainman, or Rear Chainman by giving classes of instruction and examinations.

A dinner dance was held in the Pacific Ballroom during the evening. The dinner was scheduled to begin at 6:30 p.m., and the dancing continued until 1:00 the next morning.

On Saturday, October 31st, the morning session was given over to a panel discussion of "Report on Status of Surveying and Mapping by the American Society of Civil Engineers." With ACSM President George C. Bestor serving as moderator, panelists Brother B. Austin Barry, John I. Davidson, C. R. Bosso, and Walter Hanna gave the subject a good going over.

The discussion brought out that each branch of the science of surveying and mapping has serious interest in the professional, technical, subprofessional, and nonprofessional aspects confronting all fields now, tomorrow, and in the future, especially in the matter of gearing practice and education to the future while time and the experience of those professionals presently practicing still permit. It is time to take serious inventory and take objective action accordingly. There was general agreement that some real national census of surveying requirements is the only way we will get the schools to reconsider the trend away from surveying.

The luncheon on Saturday was held in the Golden State Room, and President Bestor spoke concerning his trip to Krakow and Moscow last September.

President Bestor stressed plans and preparation for the 1961 meeting of the Federation Internationale des Geometres (FIG) with which ACSM has become affiliated.

Saturday afternoon was given over to a bus trip to and a tour of the famous Disneyland.

The ACSM Board of Direction held a meeting during the Western Regional Conference. This meeting was the first for which the Board of Direction ever assembled a quorum outside of Washington, D. C.

The Arizona Section, ACSM, attended the Western Regional Conference in force, and their petition to hold the 1961 Regional Conference in Arizona was approved by the Board of Direction. The tentative dates for this conference are set for sometime in November 1961—about two years hence.

The Board completed action on the approval of charters for the Hawaii Section and the New Mexico Section. The Board also completed the formalities providing for the affiliation of the Texas Surveyors Association.

Those present at the meeting of the Board of

Direction were: President George C. Bestor, Past President W. B. Williams, Executive Secretary Walter S. Dix, and Directors C. J. Aggeler, Ralph Moore Berry, William C. Cude, Duncan Fitchet, E. D. Morse, and James P. Webb.

The ACSM Nominating Committee also deliberated during the Western Regional Conference. The Committee's recommendations appear elsewhere in this "Congress News" section of this issue of SURVEYING AND MAPPING.

Personals

Mr. and Mrs. **Theodore W. Norcross,** of Chevy Chase, Md., celebrated their golden wedding anniversary on September 8, 1959, at a seaside cottage at Gloucester, Mass., with seven of the ten of the original wedding party in attendance, supplemented by about thirty of the original wedding guests. Mr. Norcross retired from his position as chief engineer of the U. S. Forest Service in 1948. He is now both editor and advertising manager of *Photogrammetric Engineering,* the journal of the American Society of Photogrammetry.

Leo M. Petersen, formerly in Salt Lake City and a member of the Utah Section of ACSM, is now Chief Cadastral Engineer, Department of Lands, State of Alaska. His mailing address is: Alaska Division of Lands, 333 D Street, Anchorage, Alaska.

Aero Service Corporation announces the election of George Strawbridge to its Board of Directors. He has purchased a majority interest in the company and will participate with **Virgil Kauffman** in its management. Kauffman will continue as President and operating head of the company. Strawbridge will be Assistant to the President.

Sheridan L. Hall, formerly with the Aeronautical Chart and Information Center, St. Louis, Mo., and Section Editor for the St. Louis Section, ACSM, is now with the Technical Publications Organization, Western Electric Company, Bell Telephone System, in Winston-Salem, North Carolina.

Captain Elliott B. Roberts, who retired from his position as Chief, Geophysics Division, U. S. Coast and Geodetic Survey, on August 31, 1959, has been recalled to active duty for an indefinite period as Special Assistant for Research and Development.

Dr. Leroy R. Alldredge, formerly with the Operations Research Office, Johns Hopkins University, has been named as a Research Geophysicist with the U. S. Coast and Geodetic Survey. He will be responsible for planning and conducting studies in basic physical principles governing the behavior and interactions of the earth's magnetic field, the ionosphere, and cosmic radiation, all of which will affect space travel. He also will promote effective utilization of geophysical information in both scientific and engineering fields, such information to be derived from many sources including data from artificial satellites.

G. C. Tewinkle, Photogrammetry Division, Coast and Geodetic Survey, will attend the Graduate School of the Department of Civil Engineering at the Massachusetts Institute of Technology during the academic year 1959–60.

Lieutenant Colonel James Irving Thompson, recently Commanding Officer of the Army Survey Establishment and for the past year acting Director of Military Survey, has been appointed Chief of the Air Survey Section of the Topographical Survey, Surveys and Mapping Branch, Department of Mines and Technical Surveys, Canada.

Past President **Lester C. Higbee,** just returned from an extended tour of the European Continent, presented ACSM compliments to the Association of Provincial Land Surveyors of Nova Scotia at their annual meeting in Halifax at the Lord Nelson Hotel, November 16–17, 1959. Mr. Higbee presented a talk about his travels to the instrument and optical centers of Europe.

C. C. Lindsay, a member of the Advisory Council, ACSM, has moved his office to the new Barclay Building located at 35 York St., Westmount, Quebec, Canada.

Deaths

Douglas L. Parkhurst, 66, who retired from his position as Chief, Instrument Division, Coast and Geodetic Survey, on July 31, 1959, died suddenly at his home, 4602 Norwood Drive, Chevy Chase, Maryland, on October 12, 1959. Mr. Parkhurst had served the Federal Government for 42 years at the time of his retirement, and for 36 years of that time he had been with the Coast and Geodetic Survey. He is probably best known in surveying circles as the developer of the Parkhurst theodolite, a nine-inch, two-micrometer, direction theodolite used for many years by the Survey on its first-order triangulation.

Born in New Hampshire, Mr. Parkhurst was

possessed of a vast amount of what is often referred to as "Yankee ingenuity." He was a graduate of the Worcester Polytechnic Institute at Worcester, Mass. This combination of native ability and sound training gave him an almost uncanny ability to come up with useful results, no matter what type of equipment problem arose in connection with the work of the Survey.

The sequel to the story published in SURVEYING AND MAPPING, September 1959, page 373, under the caption "Manhattan College Camp Aids in Search," has been written. We are in receipt of photocopies of items in two New York papers of October 4, 1959, which state that on that date the remains of David Raleigh were found near a rock in a gully in a wooded area about a mile from where the boy originally disappeared on June 13, 1959.

—EDITOR

(Continued from page 511.)

the aeronautical chart constitute the center of interest."

Further, "the discourse pays tribute to the work performed in the individual states as well as to the fruitful international cooperation. Thus, the development of the aeronautical chart reaches from Hermann W. L. Moedebeck to the 'Federation Aéronautique Internationale,' the 'Commission Internationale de Navigation Aérienne' and further to the 'Internationale Civil Aviation Organization' and covers half a century during which the field of aviation cartography has experienced a tremendous growth."

WALTER W. RISTOW

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(See page 529.)

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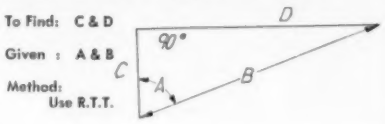

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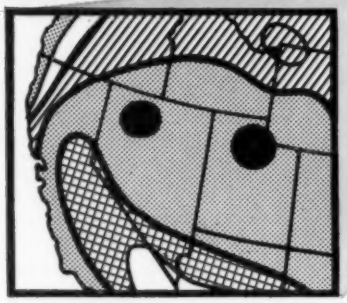

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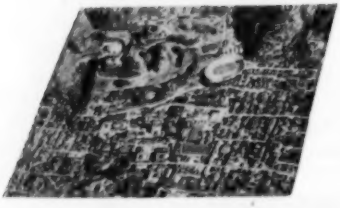

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AMBERS, Harvey Jay, 1430½ S. Orange Grove Ave., Los Angeles 19, Calif.—Civil Engineering Assistant, Los Angeles County

ANDERSON, Elmer E., P. O. Box 1230, Sitka, Alaska —Director Public Works

ANDERSON, Miss Mary C., Box 3949, Star Route B, Spenard, Alaska—Cartographic Compilation and Computation, F. A. A.

ASHMAN, Douglas Ross, P. O. Box 1363, Tillsonburg, Ont., Canada — Apprentice, Ontario Land Surveyor

AUGUSTSON, L. B., 1356 Sequoia Ave., Tulare, Calif.—Civil Engineer

BAGARIA, Robert J., 2191 Gate St., Brunswick, Ga. —Land Surveyor and Draftsman, Brunswick Pulp & Paper Co.

BAILEY, Donald R., 3788 McCray St., Riverside, Calif.—Chief of Party, Albert A. Webb Associates

BARKER, George M., Bldg. 25, Federal Center, Denver 25, Colo.—Civil Engineer, U. S. G. S.

BARNES, Albert H., Speed Scientific School, Louisville, Ky. — Assistant Professor, University of Louisville

BARRON, Roger T., 516 Second Ave., Fairbanks, Alaska — Cadastral Engineer, Bureau of Land Management

BATEMAN, Samuel A., 4709 Delamar Ave., N.E., Albuquerque, N. Mex.—Transitman, Public Service Company of New Mexico

BAXTER, Charles J., 8307 Freret St., New Orleans 18, La. — Assistant Chief of Survey, Fromherz Engineers

BEACH, Robert Frank, 2520 S St., Apt. 3, Sacramento, Calif.

BEAR, David L., Box 3171, East Chester, Anchorage, Alaska—Surveyor and Engineer, Bureau of Public Roads

BECK, Milo E., Rifle, Colo.—Civil Engineer, U. S. G. S.

BECKHAM, Milton, 1349 Main St., Perry, Ga.— Surveyor

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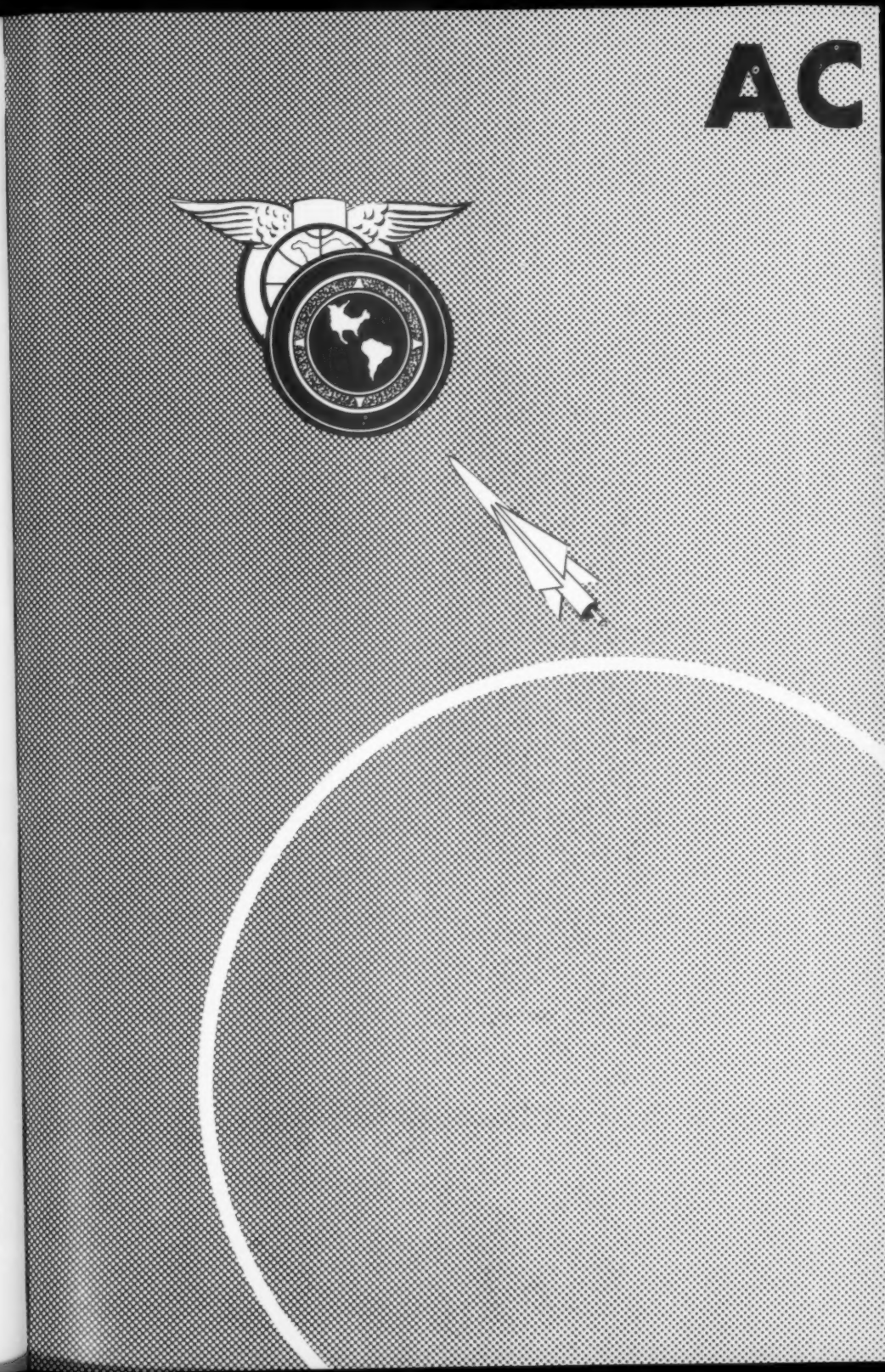
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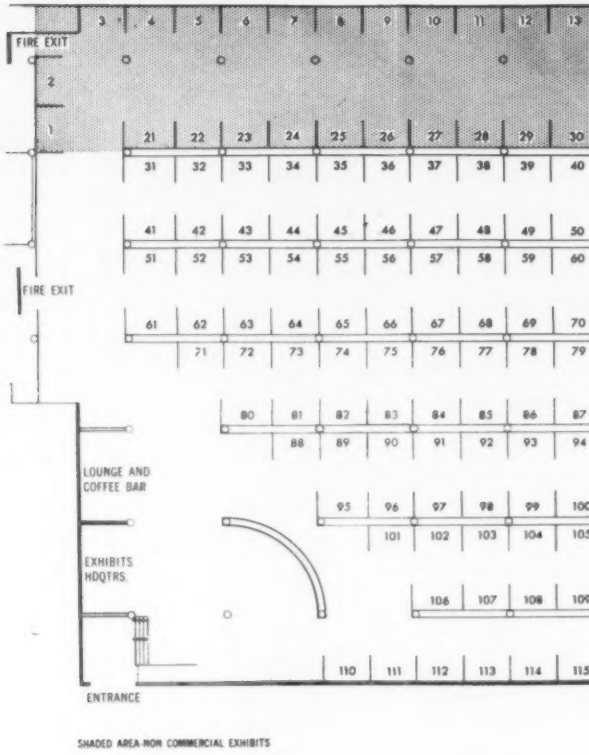

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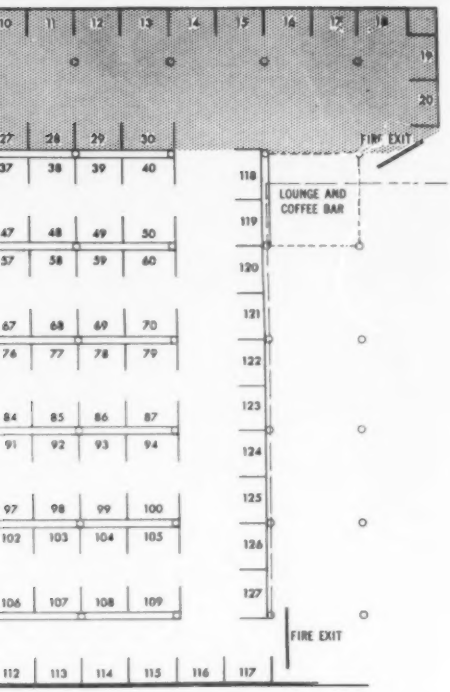

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Watch the following pages . . . .

PROGRAM PREVIEW

1960 ACSM—ASP Consecutive Meetings and Co-Exhibit

March 20–26, 1960, Shoreham Hotel, Washington, D. C.

ACSM Twentieth Annual Meeting—March 20, 21, 22, 23
Sessions—Monday, Tuesday, and Wednesday morning

ASP Twentysixth Annual Meeting—March 23, 24, 25, 26
Sessions—Wednesday afternoon, Thursday, and Friday

ACSM PROGRAM

With the exception of Education, all Technical Divisions will hold separate Division meetings. These meetings will be scheduled so that the membership of ACSM with wide fields of interest will be able to attend at least two meetings.

CARTOGRAPHY: The program will feature papers covering various aspects of mapping requirements and problems relating to space flight and space navigation. Also featured will be a presentation covering charting of the submerged three-quarters of our planet, a task increasingly recognized as deserving attention comparable to that given our space environment. The program will also include papers describing new developments in cartography in various government agencies.

CONTROL SURVEYS: The Control Surveys Division will sponsor a symposium on distance measuring systems. During the plenary session, it is planned to have representatives of the manufacturers of distance measuring equipment bring us up-to-date on new developments. A panel discussion by users of these systems will be held during the Division meeting.

EDUCATION: Participation in the general program will consist of a report on an analysis of a questionnaire distributed in California to determine the demands for surveying personnel, and of recommendations for a nationwide survey which the Division plans to conduct. The title of the paper will be "Pilot Study of Demands for and Inadequacy of College-Trained Surveying Personnel." An Education Division Business meeting will be held.

TOPOGRAPHY: Plans to have two presentations on subjects of widespread interest to surveying and mapping practitioners. The first on the recently adopted policy of subdividing the public lands of Alaska by protraction, will be given at the plenary session. The multiple phases of this subject: Computation of corners, protraction of land lines on topographic maps, and legal aspects of the system, will certainly be of great interest to all surveyors and mappers.

The second presentation will be a symposium on the National Map Accuracy Standards. The symposium will include a review of the development of the Standards, reports on experiences with the Standards by representatives of private and government mapping organizations, and a summation pointing out what is indicated in the way of improvements after nineteen years of experience.

PROPERTY SURVEYS: On Monday morning, the Division meeting will hear from Committees of the Land Surveyors National Conference, who will report on Ethics, Fees and Salaries, Publications, Professional Reliability Insurance, and Map-Filing Procedures throughout the country.

The plenary session will feature a panel discussion on the role of the land surveyor in the past, present, and future of urban/city land planning.

A business meeting will be held Friday evening, which will include the Second Annual Meeting of the national representatives to the Property Surveys Division of ACSM. These delegates represent the Sections of ACSM as well as State surveyors organizations.

INSTRUMENTS: At the plenary session, a panel of experts representing various instrument concerns, will discuss improvements on the latest items of surveying and mapping equipment. Two technical papers also will be given; one on the subject "Use of the Coordinatograph," which describes its application in the construction of the control grid net and the plotting of ground control points. The second paper is a discussion on the principles of the Automatic Level. There will be a business meeting.

Second International Cartography Course

The Second International Cartography Course will be held at the Swiss Federal Institute of Technology at Zurich and at the Topographical Survey of Switzerland at Wabern/Berne, from March 7 to April 30, 1960.

The object of the course is to teach essential parts of modern methods of mapping. There will be detailed treatment of the contents and graphical representation of topographical as well as the thematic (employed) maps. Up-to-date proceedings of designing and reproducing maps will also be dealt with. Not to be discussed will be the system of projection, geodetical and topographical surveying, and linguistic problems of nomenclature.

The first part of the course will last six weeks and takes place at the Swiss Federal Institute of Technology at Zurich. The second part of the course continues for two weeks at the Topographical Survey of Switzerland at Wabern (near Berne).

Instruction will be given in the form of lectures, discussions, and practical work, daily from 9 to 12 a.m. and from 2 to 5 p.m. Weekends will be free, but on Saturday mornings the practical study rooms at the Swiss Institute of Technology will be open for the use of those attending the course.

The lectures will be given in German, but there will be simultaneous translations in French and English. In the discussion and practical work, German, French or English may be spoken.

The following are eligible to attend the course: Graduate cartographers (topographers, photogrammetrists, engineer-cartographers, or geographers who are already well acquainted with cartography); also chief-cartographers or cartographers assigned to direction of practical work, without university degrees. What is especially desirable is that the participants possess a certain experience in cartography and are capable of drawing maps.

In order to obtain the most beneficial results, the number of participants in this course will be limited to 25. For this reason, and also to make the course accessible to as many countries as possible, the organizers reserve the right to select applicants.

The course amounts to 700 Swiss francs per participant, payable to the Swiss Federal Institute of Technology on account of the International Cartography Course before March 1, 1960, but not before Prof. Dr. E. Imhof has confirmed the admission of the applicant. All necessary material will be provided free of cost by the direction of the course.

The expenses for eight weeks at Zurich and Berne will amount to approximately 900 Swiss francs (hotel- or private rooms, meals in restaurants or at the University boarding house). Additional expenses for excursions (railway fees and others) will come to approximately 100 Swiss francs.

All correspondence should be addressed to: Kartographisches Institut der Eidg. Technischen Hochschule, Prof. Dr. E. Imhof, Leonhardstresse 33, Zurich, Switzerland.

Applications should be at the above address not later than December 31, 1959, and should contain the following: Surname, name, date of birth, domicile and address, nationality, languages, as well as a brief description of the candidate's professional education, activity, and occupation.

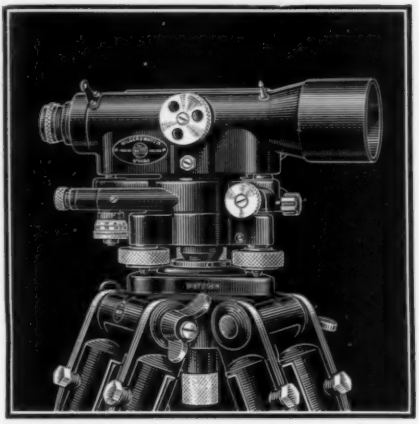
Status of Aerial Photography

The June 1959 index STATUS OF AERIAL PHOTOGRAPHY, a sheet of the NATIONAL ATLAS OF THE UNITED STATES, issued annually, is an inventory of aerial photography of the United States, Puerto Rico, and the Virgin Islands. This year, for the first time, it shows 100 percent coverage except for a small area of Hawaii.

The index maps shows all areas known to have been photographed by Federal, State, and Commercial Agencies. Where areas have been Photographed more than once for special purposes, the coverage considered most suitable for average needs is shown as primary photography by color pattern. The secondary photography is not shown. Detailed explanation is given on the back of the map. Copies of this index map may be obtained by writing to the Map Information Office, U. S. Geological Survey, Washington 25, D. C. Further information regarding aerial photography may be obtained from the same agency.

Reference numbers for the index, STATUS OF AERIAL PHOTOGRAPHY, are: Library of Congress, G 3701.B5; Dewey Decimal, 526.0973.

—WALTER S. DIX



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Some Geophysical Programs of Cambridge Research Center

The following resumé of a talk given by Owen W. Williams of the USAF Cambridge Research Center at the May 27, 1959, meeting of the St. Louis Section, ACSM, was prepared by Sheridan L. Hall, Section Editor.

The Geodesy and Gravity Program of AFCRC as related to the IGY and the overall objectives were discussed. The ultimate objectives are to: Provide the information needed to compute an ellipsoid or other mathematical surface which will most accurately fit the geoid; to unify the geodetic and gravimetric datums of the World; and to determine the variations of the Earth and planetary gravimetric fields.

For the IGY extensive baselines have been established by quartz pendulum and gravity meter throughout the Far East, the Southwest Pacific, Antarctica, and South America. The geoidal analysis of gravity data at Ohio State University for Scandinavia, Japan, and the Atlantic is nearly complete. Through Georgetown College Observatory photoelectric observations of the 1952 solar eclipse are being reduced; work on reduction for the 1954 eclipse and plate measurements for the 1947 and 1955 eclipses is either completed or nearly so.

A pure geodetic satellite system is being studied. This has justified further study of rocket triangulation techniques, electronic long line measuring devices, and a Hiran azimuth determination capability.

AFCRC, cooperating with ABMA, has been studying the effect of the Earth gravity field upon missiles in flight. A result has been "The New Theory of Gravimetric Geodesy," of which Part I has been completed. In this, the normal field is extended to high elevations and presents a new intermediate reference surface called the "Spherop," whose regular surface enables greater speed and accuracy in mathematical reductions.

Still other activities concern such as the establishment of a baseline along a coastal shelf (with Lamont Geological Laboratory); the feasibility of airborne gravity observations of high accuracy; the development of a mobile and highly accurate pendulum apparatus to play an integral part in the airborne program; and techniques of camera plate reduction which is involving such studies as refraction errors to be anticipated with the use of specific types of optical equipment.

MEETINGS

PAST, PRESENT, AND FUTURE

The **Instrument Society of America** held its 14th Annual Instrument-Automation Conference and Exhibit in Chicago, Illinois, September 21–25, 1959, with sessions in both the Palmer House and the Hotel Morrison. The exhibits were displayed in the International Amphitheater.

The **North Carolina Society of Surveyors** held its fall meeting in Greensboro, N.C., on October 30, 1959.

The 53rd Annual Meeting of the **Canadian Institute of Surveying** is to be held at the Chateau Laurier, Ottawa, Canada, on February 10, 11, and 12, 1960. Social activities include a program for ladies. Reservations for hotel accommodation should be made early. A.C.S.M. members are cordially invited to attend.

Now Hear This

Tellurometer, Inc. the United States distributor of Tellurometer systems, has announced the establishment of a complete new laboratory for testing and servicing this equipment, as an expansion of its service to the users of the several hundred systems which are already in use in this country. Users of Tellurometer equipment who encounter unique problems in distance measurement are invited to call or write to Tellurometer Service Center, 5451 Randolph Road, Rockville, Maryland.

Gravity observations at ground stations have been "old hat" for a long, long, time, but many of us can well remember when Dr. F. A. Vening Meinesz made gravity observations at sea for the first time. Now, according to a joint announcement by Fairchild Aerial Surveys, Inc., Los Angeles, Calif.; LaCoste-Romberg Company, Austin, Texas; and Gravity Meter Exploration Company, Houston, Texas, it is now possible under favorable circumstances to measure gravity in the air to an accuracy adequate for geodetic and certain geophysical purposes.

The *USDA Graduate School Newsletter,* July 31, 1959, states that a new course, "Principles of Hydrography," is listed in the 1959–60 catalog of the U. S. Department of Agriculture Graduate School. It also stated that, from the viewpoint of high level officials more astronomy courses, designed especially for employees in agencies concerned with the exploration of outer space, are among the urgent training needs. Dean Grover Angel, George Washington University, is quoted in the *Newsletter* as follows: "Education by television will be extended to a wide variety of courses for credit, and non-credit."

Canada, which possesses the longest coastline of any country in the world, is taking steps to expand oceanography in the Department of Mines and Technical Surveys to fill the need for oceanographic data on its coastal waters and for defense and resource assessment purposes. It is setting up on the east coast, in Bedford Basin near Halifax, a three million dollar oceanographic institute, which will have the facilities to allow studies in any phase of the science. The new institute will take five years to complete and when in operation will have a staff of some 300 oceanographers, hydrographers, submarine geologists, and other scientific personnel, plus supporting staff, and an operating fleet of ten oceanographic vessels.

A specially prepared catalog which lists engineering equipment and supplies for student engineers, entitled "Your K&E College Buying Guide," may be obtained from Keuffel & Esser Co. Adams and Third Streets, Hoboken, N. J. The booklet is designed in particular to provide freshmen engineering students with facts on their current and future engineering needs.

A new illustrated catalog, "Optical Tooling and Industrial Alignment Equipment," covering their complete line of equipment for production tooling, machine alignment, quality control, and inspection, is available from Keuffel & Esser Co., Adams and Third Sts., Hoboken, N. J.

The American Standards Association has issued a 52-page publication, "Current Projects of the American Standards Association" (current as of July 1959) which lists the 425 projects under which standards have been and are being developed and revised for presentation to the Association for approval and addition to the more than 1,800 such standards already approved. A rather thorough inspection of the listed projects fails to reveal any of special interest to surveyors and mappers, though some of the projects under the classification "PH—Photography and Motion Pictures" might be of interest to those working in the field of photogrammetry, and one or two of the projects under the classification "Y—Drawings, Symbols, and Abbreviations" might be of interest to draftsmen and those concerned with the prepa-

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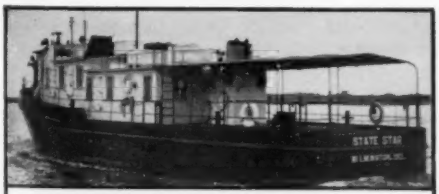
ration of illustrative material. Further information may be obtained from American Standards Association, 70 East 45th Street, New York 17 N. Y.

A three-color leaflet descriptive of the unique features of Marathon Long Line and Wide Line ruling pens, claimed to rule from five to eight times more line per filling than ordinary ruling pens, is available from Keuffel & Esser Co., Adams and Third Sts., Hoboken, N. J.

As a result of four years of research, LogEtronics, Inc., has developed two models of enlargers which permit the application of their automatic electronic dodging system to the production of color prints.

In connection with the construction of two refuges on Mont Blanc in the French Alps, for mountain climbers of the French Alpine Club, a Hiller 12 E helicopter transported 19 tons of building materials, from a base at an elevation of 5,500 feet to the two building sites at elevations of 8,400 and 9,400 feet, in 7½ hours flying time.

The following is from a letter addressed to Victor H. Ghent, Secretary, Property Surveys Division, ACSM, by James W. Robinson, Pub-



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Kargl Company, Inc., has just issued the sixth in a series of special bulletins listing bibliographic information on photogrammetry, photography, and surveying and mapping. Copies of this or previous bulletins may be obtained by writing to the company at P. O. Box 6647, San Antonio 9, Texas. For additional information concerning this series of bulletins, see SURVEYING AND MAPPING, January–March 1958, Vol. XVIII, No. 1, page 126.

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Bibliography of Periodical Literature on Canadian Geography 1930 to 1955

As Bibliographical Series No. 22 of the Department of Mines and Technical Surveys, Geographical Branch, of Canada, a *Bibliography of Periodical Literature on Canadian Geography 1930 to 1955* is being prepared for publication in six separate parts. Each part is available, at the price of fifty cents, from the Queen's Printer, Ottawa, Canada. Parts and catalog numbers are as follows:

Part 1 (M62-22/1) Canada—general.
Part 2 (M62-22/2) Atlantic Provinces.
Part 3 (M62-22/3) Quebec and Ontario.
Part 4 (M62-22/4) Prairie Provinces.
Part 5 (M62-22/5) British Columbia.
Part 6 (M62-22/6) Northern Canada.

Of interest to cartography and surveying and mapping are the bibliographical items listed under Mathematical Geography, which are of cartographic, surveying, and mapping interest, as concerned with the geography of Canada. Other items of interest to ACSM members are listed under Urban Geography under the major title of Human Geography.

The scope of interest in this geographical bibliography covers Bibliography; Biogeography; Biography; Description and Travel; Economic Geography, which, in itself, covers Natural Resources, Mineral Resources, Fuels, Agriculture, Forest and Forestry, Animal Resources, Power, Industries, Transportation and Communication, and Trade and Commerce; Historical Geography; Human Geography, which, in itself, covers Ethnic Groups, Medical Geography, Population, Immigration, Social and Cultural Geography, and Urban Geography; Mathematical Geography; Physical Geography, which in itself, covers Climatology and Geology; Place Names and Geographical Nomenclature; Political Geography; Research; Status of Geography; and Strategic Geography.

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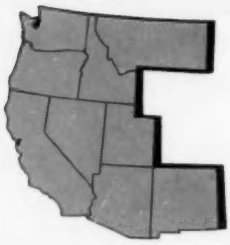

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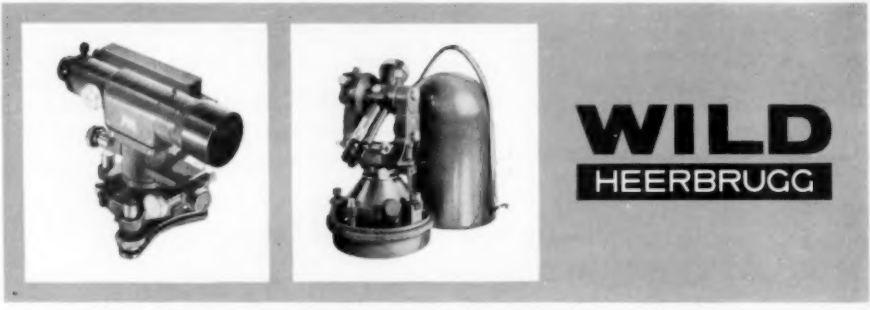

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NOTE:—Manuscripts of articles should be addressed to Chairman Whitten, Coast and Geodetic Survey, Department of Commerce, Washington 25, D. C.

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For further information, write to

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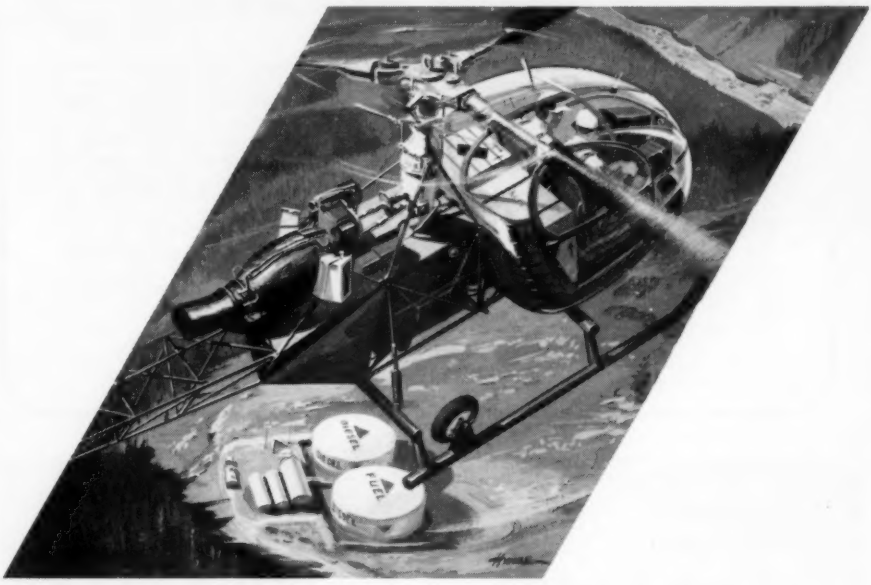

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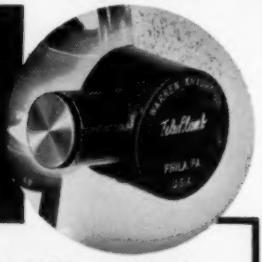

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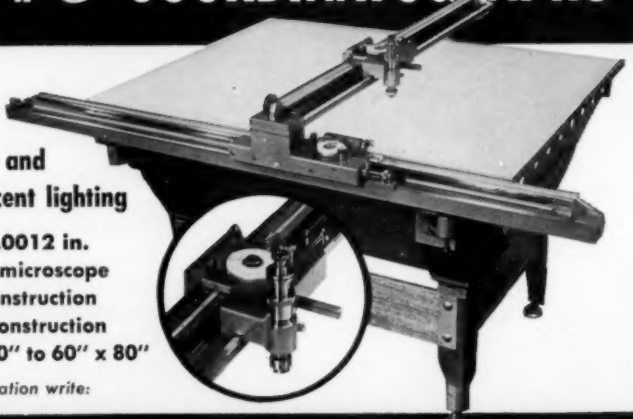

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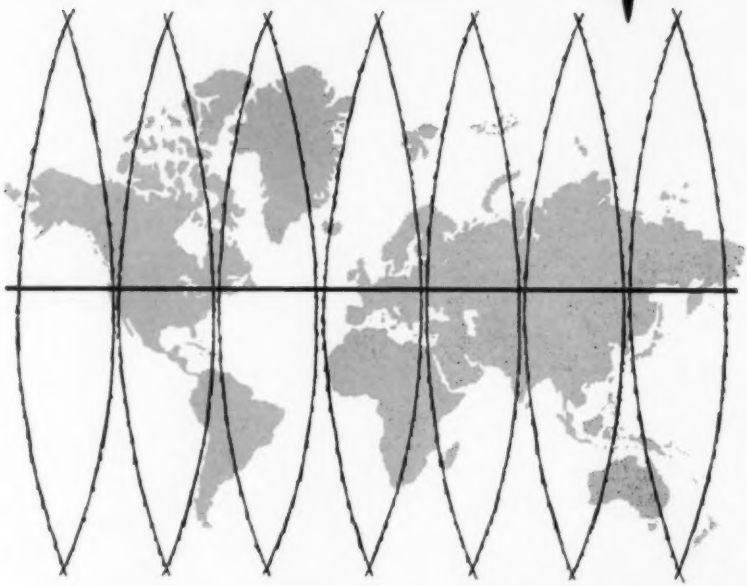

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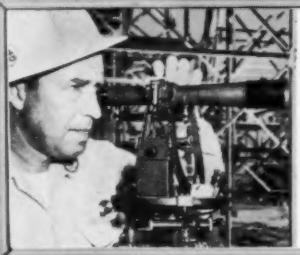

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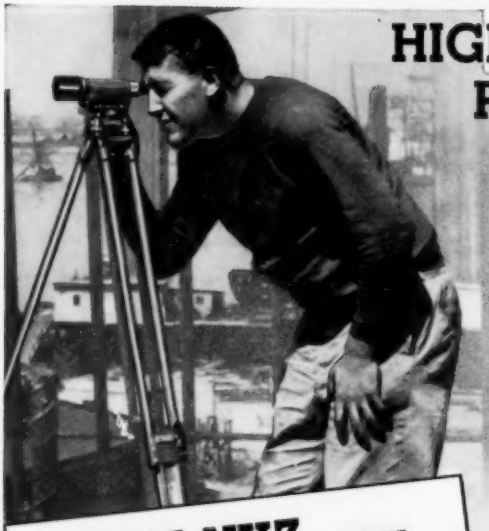

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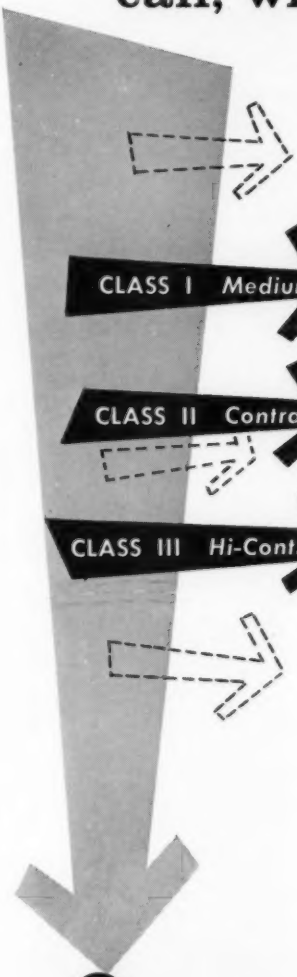

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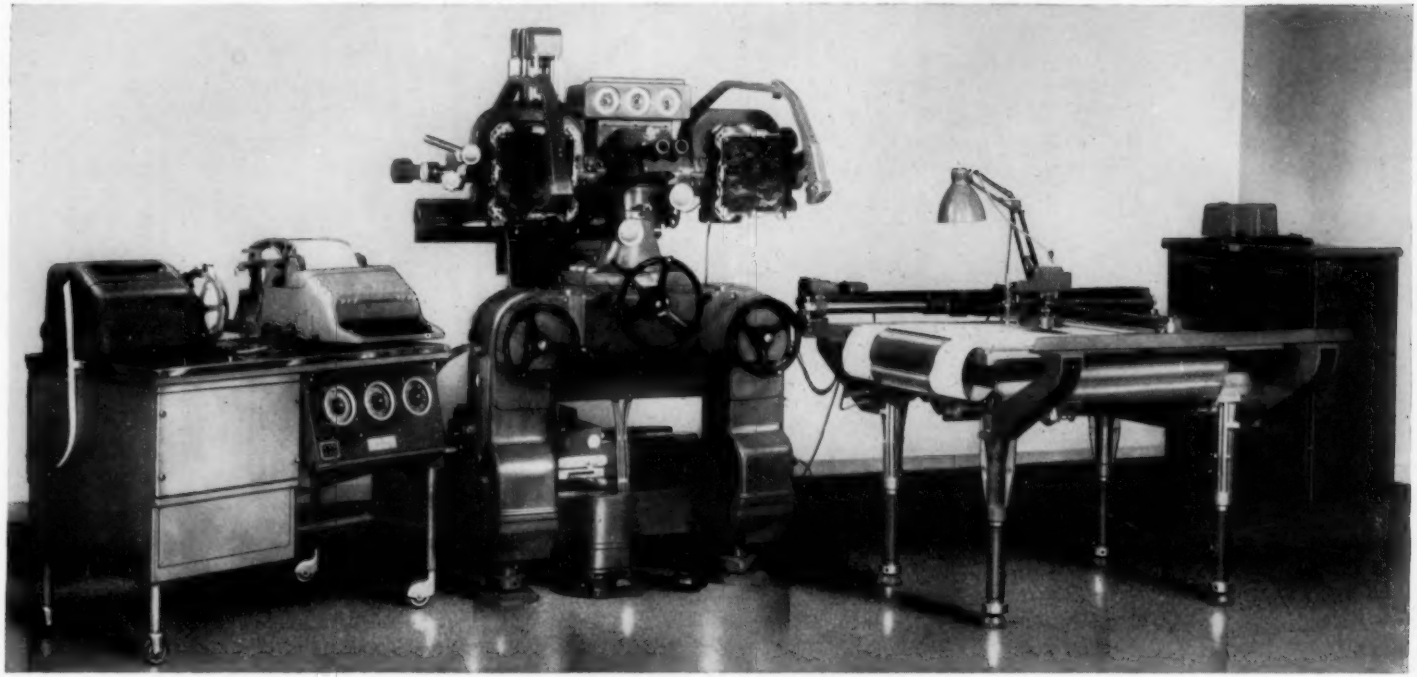

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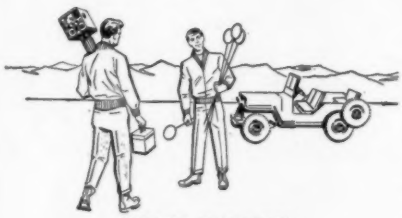

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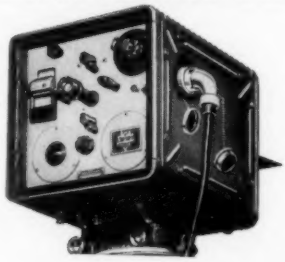

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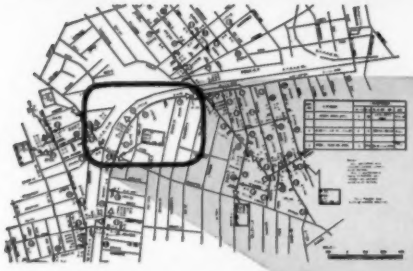

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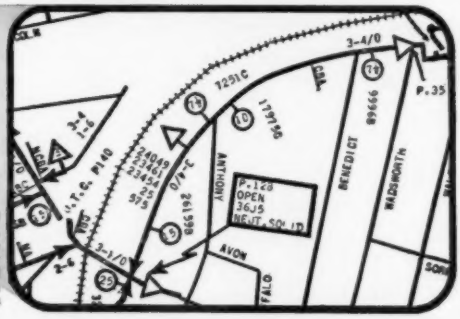

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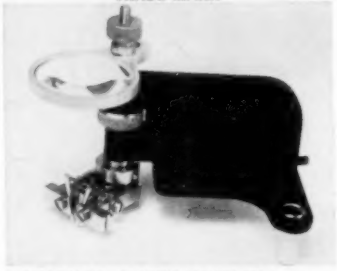

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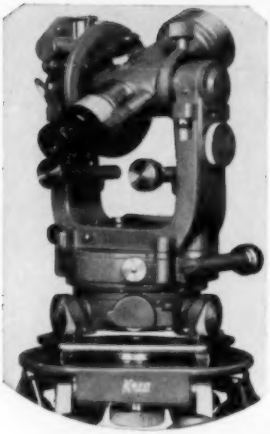

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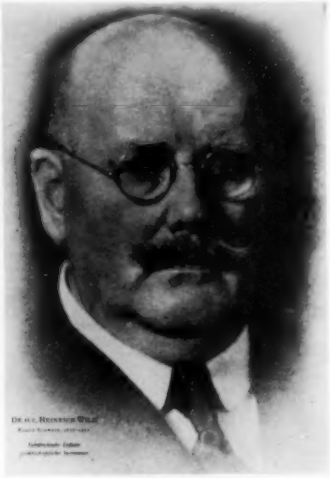

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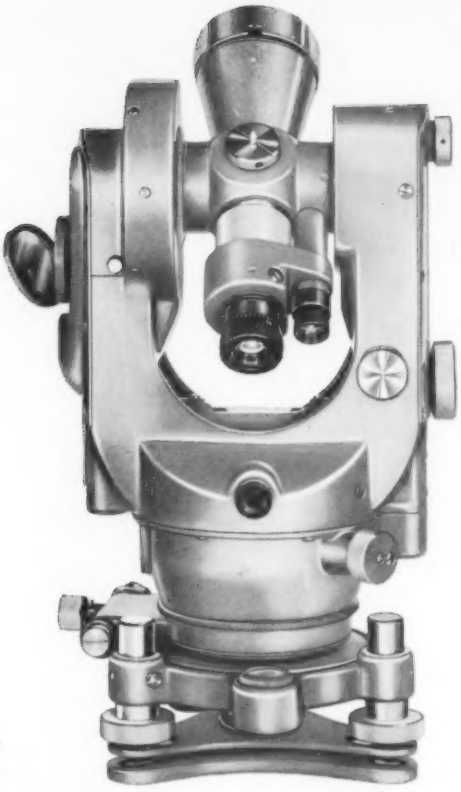

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